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BOTANICAL TEACHING[1]

I. ON THE PREPARATION OF BOTANICAL TEACHERS

SOME months ago a suggestion was made that at this dinner we should ask ourselves the question: Why is it that with the enormous classes we are having in botany there is a marked dearth of properly trained men who can serve as instructors in colleges and universities?

In order to be sure that I was right in regard to such a dearth I wrote to something like a dozen of the professors of botany in prominent institutions in the country, making the inquiry whether they had noticed the same thing, and uniformly the answer was that there seems to be a shortage in the supply of material for instructors (in the college sense) and young men for other minor positions.

I think there is no lack of men who are ready to be professors of botany. I am very certain that there is no trouble here, but when a professor who knows what he wants asks for a man who can take up this work or that work as an instructor, the situation is quite different.

What becomes of the great number of students who are in our classes? The professor of botany in the University of Minnesota tells me that he has over 500 students in his beginning classes. In Nebraska we have about 350, and elsewhere I find essentially the same thing. Enormous classes are pursuing general botany, and

[1] From the stenographic report of oral addresses delivered at the conference on botanical teaching at the dinner for botanists, Minneapolis, December 29, 1910.

yet so few are going on and qualifying for even the minor teaching positions.

In talking this matter over recently with a clergyman, who is also a botanist, he said, "The truth is there is less real scholarship among students to-day than there used to be," and I think there is a grain of truth in his remark.

I stopped our professor of Greek the the other day and asked him what he thought of our botanical problem. He said, "It is just because the students have got into the way of taking nothing but first-year work. They take first-year Greek, and that is the end of it, first-year college Latin, first-year geology, first-year philosophy, first-year physics, first-year astronomy, and first year American history, and so on." There is a good deal of truth here too.

Here then is something to be thought of. Students in the universities are taking beginning work only, and botany suffers with all other subjects. As educators we should give serious consideration to this matter. It is not right that we should permit pupils to be taking these little educational bites of all kinds, and in any sequence; on the contrary they should be required to sit down to a good square educational meal taken in proper order.

It makes one sick at heart to witness what is actually going on in the universities under our very eyes. We spread out before the students the courses we have to offer, and in tempting phrase try to induce as many as possible to enter our classes. I am reminded of the proprietors of bazars who have trinkets for sale, and try to induce every passer-by to purchase, by loud insistence upon the advantages resulting from such a transaction. And the bewildered student is left without a guiding suggestion in the bulky catalogue. Oh, the folly and the cupidity and the cowardice of the system that bids the student make a wise choice, but gives him no guide! Had I the power I should certainly sweep out of existence all of the go-as-you-please arrangements in the universities, and I should substitute for them a logical and carefully selected sequence of studies.

There is no doubt that many young men turn from botany into various related subjects, as agronomy, horticulture, forestry, etc., and I have no complaint to make if they do; but these subjects do draw students away from scientific botany, and so reduce the number available for teachers.

Nearly every one of the professors to whom I sent inquiries referred to the low remuneration that comes to the young man who has fitted himself to be an instructor in botany in college or university. And no doubt this is a potent factor, and it is likely to turn away many of the best men from the teachers' ranks. The fact is that a bright young man looking to his life-work will be turned more or less this way or that way, as he sees that the world is ready to pay him for it. Now I dislike to have to say this; we like to think that the best men will go forward if they have to go with only a crust a day, and all that. There is very little truth in it, however. We ourselves go where we find employment and adequate remuneration. And so young men are lured away from botany with its low remuneration, leaving us too frequently only the poorer men.

Now we do not like to acknowledge this condition of things. We like to think that science is a sacred calling, something apart from business, and we do not like to acknowledge that a man who has the scientific spirit in him can possibly be turned aside by any thing like a salary. But botany is a business, and it is not sacred any more than selling shoes or editing a newspaper is sacred. And as most men

can succeed in more than one of several pursuits, so most men can succeed in botany if they take hold of it seriously. Here again we do not like to acknowledge the truth of this statement; we think that we are made of different kind of stuff. But I do not believe it for a moment. I have no doubt that some of us here might have been millionaires if we had gone into business. What I want to insist upon is this: that we look at this matter squarely, and not try to make out that we are a different kind of people, and made out of different material. We are not, and our business isn't any different; it isn't any more sacred. We must be candid in this matter and admit that our profession hasn't anything sacred in it; there is no sacred fire that must touch every man before he can be a botanist. There is nothing in this sentiment. As I said before, botany is comparable to the selling of shoes, or the running of a newspaper. Botany is not extraordinarily difficult, and it does not require geniuses; only just good ability and perseverance; that's all. So men who might have been botanists will continue to choose other vocations, and some others will choose to become botanists, and some of either will fail, and some will succeed, just as is always the case. Some men who might have become brilliant botanists will become brilliant business men instead. It has been said that "botanists are born and not made." Maybe they are, but if so, they are born with a multiplicity of other possibilities also.

Brethren, let us remember that we are quite like other men, and that with us the factor of remuneration cuts as great a figure as it does elsewhere in society, in the selection of a vocation.

Many of those to whom I wrote expressed doubts as to the wisdom and effectiveness of some of our teaching, and out of these doubts that have been passed along to me I obtain these suggestions:

There is some faulty elementary instruction; probably I should have said much faulty instruction. Again, we do not begin early enough in bending the human twig in the right direction to make a good botanist. There is a good deal of improper presentation. We too often try to offer "attractive" courses for the sake of drawing students into our work. And this is necessarily fatal to a scientific presentation. Some of my correspondents suggest that there are such persons as incompetent assistants who supervise our laboratories, and by their incompetence tend to drive away some men. Further, it has been suggested that probably there is nowadays too great a neglect of field work. It used to be that in vacation time the young botanist had something to think about, and something to do. He could go out in the woods on long botanical trips. He can not do this to-day if he is a mere laboratory man. He can not conveniently carry his microscope along with him. A vasculum is a great deal easier to carry than is a microscope, and far easier to handle. I think my correspondent was right: we have lost something of our hold on young men because we have nothing to substitute for the old-time field botany. You can not do laboratory work in vacation. Of course you can go to summer school, and sit down by the side of a lake and study some of the algæ found there, but even that doesn't compare favorably with the old-time tramping for miles and miles through the woods and swamps, with a vasculum slung over your shoulder.

Some of my correspondents suggested that there is too much narrow training nowadays. I think this probably comes rather close to some of us. We get hold of a bright young fellow after he has had a half year's work, or little more, and put him

into something that narrows him to a single line of work. He makes a good specialist, but he is too narrow for a botanist. He is far too narrow a man to be put in charge of classes in general botany.

Again, I think we set our requirements too high for the young teacher. We demand much more than is really necessary. We older men forget how very little we knew when we began teaching. We act as though we felt that men must be stuffed with every detail of technical knowledge before they are ready to be sent out as teachers. We want these men to be prepared all around, and well prepared, too. This is all right enough when you are thinking of specialists to fill positions calling for a particular preparation. But when the inquiry is made for a young man to be an instructor we should go back to our own experience. We did not know much, but we got on somehow, and our classes seemed to learn from us. Yet today we act as though we felt that we must send out young teachers who are perfect machines for any kind of botanical work. We act as though we were not sending out men with initiative and with ability.

Let me illustrate my meaning by an example. A few years ago the government sent to Nebraska for a young fellow who was not especially well prepared in botany and took him to Washington, and after a few days shipped him down to Alabama, and put him in charge of a group of men. They were studying pecan tree diseases. This man from northern Nebraska, who had never seen a pecan tree, found himself in charge of a squad of men engaged in budding pecans. He knew nothing about budding pecans. But he had initiative enough to master the situation, and after a night's study and practise he went ahead as though he had been budding pecans all his life, *and succeeded!* I did not train that man in pecan budding; in fact I could not have recommended him as a budder of pecans. Yet he "made good," not because he had been stuffed by the right kind of knowledge, but because with his foundation of knowledge he had energy and ability.

Now let us ask whether we are not setting up a wrong standard? We are thinking of how full a man is of the botany we have put into him. Should not our attitude be this: "this man has made a good beginning, he has the right kind of material in him, take him and let him grow up with his work."

Now there is not one of you here who has not learned ten times more of botany out of college than he learned in college. You had the qualities in you to make you successful, and had a fair beginning in the science. I was quite interested in looking over the summaries in the second edition of the "American Men of Science" to find that the botanists are requiring young men to work longer for their bachelor's and doctor's degrees than are the chemists, physicists, zoologists, mathematicians or geologists. I do not believe botany is proportionally that much harder. We are putting too high a value on what we are *putting into* our students, and neglecting the man himself. We are in danger of having men grow "stale," as the athletes say. Probably we keep our men with us too long. We should send them out while they are still fresh and vigorous.

I think we should map out very definitely a series of successive semesters of work that should constitute fair preparation for the average young man who wishes to become a botanist. Such a botanist should be ready to begin teaching, or even investigating, not as an expert, but as a beginner. And every one must necessarily be a beginner in his work at one time in

his life. Let us think of these young men that we are suggesting for positions as beginners merely; and when you send one to me I shall take him as a beginner, not as a finished botanist. Yet very commonly we say to our students that they can not begin either investigating or teaching until they have made a special study in particular fields. We try to impress them with the great importance of graduate work, and the littleness of their present knowledge, and we impress upon them also our conviction of their general inability.

We need broad general courses with definite beginnings and endings, and including something of all the phases of the science, well wrought together into one science, and not courses consisting of a collection of disjointed and disconnected phases of the subject. I think here is one of our mistakes. As one of my correspondents wrote very emphatically, "this splitting up of the science so that the student thinks of it as morphology, so many hours; physiology, so many hours; pathology, so many hours; and mycology, and algology, and bryology, and taxonomy, etc., has done much to discourage young men."

No doubt also we can help to make more botanists by encouraging an *esprit de corps* among our students, whether they are undergraduate or graduate students. All are botanists; even the newest recruit belongs to the botanical army. Let us not withhold honor from these new additions to our force. And yet I have seen in many places a tendency to persistently belittle the knowledge of the student in his first and second years on the theory, I suppose, that it is good for a young fellow to be "taken down," and made to feel that in this stage he is little better than a fool. I do not think this is right.

Another thing that we can do is to study our men, and select the more promising. And we must not be too particular, either, in our choice. I have seen some rather unpromising men turn out to be very successful botanists. We must not turn men away simply because at first they do not seem to be promising. Some slow men finally become good botanists and successful teachers. On the other hand, I have known some brilliant men who in the end have done very little with all their brilliancy. I feel sure that as teachers we should frankly tell our students what we think they are able to do. Let us stop looking for Torreys, Grays, Farlows, Barneses, Coulters, etc. That, however, is what we are doing. We are putting up a standard that is only reached once in a long while. Let us realize that the young fellows in our classes are very much as we were—just mediocre men. Most of us are that, but we got on somehow, and have been measurably successful. And so will they. Give them a chance.

Then I fear that we have not treated botany as a profession, but merely as a subject of study. Of course it is to be studied, and of course, also, it is to be taught. But it is also a profession, and we should weave into our instruction much of the ethics of the science, whether it is to take the form of teaching or investigation. The young botanist should be made to feel that he is going to *use* his botanical knowledge, and that he can do so with entire propriety. Let us stop saying to the young man: "You do not know enough yet to begin"—but let him begin!

Now, before I come to my closing discussion I want to make a slight digression in order to speak of college courses in general, and especially the go-as-you-please method to be found in most of our institutions. I fully believe in having work prescribed as to kind and place in the college curriculum. I believe in prescribing the

necessary language work early in the course. I believe also in prescribing the other science work. The old-fashioned classical courses, with some modifications admitting science, appear to me to be about the best foundation. You ask me why so? For the reason that they began at some place and ended at some place. There was consistency and continuity, with resultant training. The so-called "free elective" plan is to me the worst of all plans. The student is dazed by the many things that he can do; and he does not know what to do. In most institutions, he is supposed to have an adviser, but, as Abraham Flexner shrewdly says, "the advice is equivalent to perfunctory consent to propositions which the student himself submits." So the student generally ends by doing a lot of the easier things in a hodge-podge, aimless manner.

Now let me make a few suggestions with regard to the courses in botany. I fear that I may shock some of you by some things I am going to say.

In the University of Nebraska we are working on a three-year schedule (in a four-year college course) for undergraduate work in botany, intended to fit men for filling instructorships in botany. I do not believe in the "quick-meal" process in education, but as I look over what I have been doing the last forty or more years, it seems to me that we can concentrate our work to such an extent that a man who brings proper preparation otherwise to the work ought to be able, in three years, if properly guided, to complete the course. We are making this schedule aggregate from twenty to twenty-five hours only—not quite the equivalent of a single study taken three years. In this time we think it is possible to take a bright young man and fit him well to begin work. Of course he will not be the equal of our older men. Let us, however, give up the idea that we can turn out young men who know as much as Dr. Coulter or Dr. Farlow. That will take years; but a man can have a good preparation for teaching botany, as good as the young engineer gets—and he is ready for work when he finishes his course. So we are working on a three-year schedule and I think we are going to accomplish with it what has hitherto taken a much longer time.

We are proceeding with the following limitations. First: Such a three-year schedule must include a general survey of the plant kingdom.

Second: This three-year course must include the essentials of cytology and histology. It may not include an extensive knowledge of them, but their technique at least, and enough so that a man has mastered a few, at least, of the principles.

Third: Such a schedule must include the essentials of plant physiology.

Fourth: It must include also the essentials of taxonomy. I will not attempt to say how much that should be, and yet I am certain that there should be a considerable knowledge of taxonomy in regard to the plants that a man is likely to come in contact with. I should feel embarrassed if called upon to teach in a part of the world where I did not know what the plants around me were. I would not like to employ a man in my department who would frankly confess that he could not tell an ash tree from a maple.

These are some of the things that should be known. There are many things I have not included, but I think that what I have put into my schedule will fairly prepare a young man for beginning to teach. He can not take my classes, perhaps, nor Dr. Coulter's classes, but he can begin where we began in teaching, and *work up!*

Now this amount of botanical knowledge,

as I have mapped it out, is very much more than many of us had when we began. It should fit a man for beginning to give instruction in the smaller colleges or in the minor positions in the universities. It should fit him to lead intelligently the students that come to him in our normal schools. I take it that it is in this direction that we must move if we are to be able to supply from our schools and our universities the men who are to follow us.

You will notice that in all this I have said—"men." I have said so because I have found that when the demand comes, it is mostly for men. I do not know why this is so. We say very pretty things about our women students, and give them good high standings, and say complimentary things about them *as students*; and yet when you yourselves look around for some one to be an instructor, and we write and say—"there is a young woman here who will make a good instructor"—you say: "Our present circumstances are such that we can not employ a woman." Here is one thing that we ought to change. The supply of competent women is much larger than of competent men, and I can assure you from experience in my own department that they make admirable instructors.

I have gone over this problem of the making of botanical teachers in this rapid way in order to stir up thought along many lines. For I hold that it is a serious problem; and that we as teachers of botany owe it to the future that we should prepare in a proper way for the succession of teachers that must follow us.

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II. THE PRODUCT OF OUR BOTANICAL TEACHING

NOTWITHSTANDING the frequent assertion that teaching of botany is not what it should be, it seems safe to say that there was never a time when there was more good teaching of the subject than we have to-day. That we should have dissatisfaction at a time when so much good teaching is being done, is not at all surprising, inconsistent or undesirable. Botany itself has grown so rapidly, its call for new researches has been so insistent, its place in the applied sciences and in the affairs of men in general, has assumed such prominence and importance, its use as a means of giving a proper education in scientific thought about things that are worth knowing has been so vigorously claimed, that in consequence our attention is directed as never before to the possibilities and errors of botanical teaching.

The teaching is not poorer—we merely know more about it. Present practises are not wholly bad and need not be discontinued, but with the increasing richness and diversity of botanical knowledge, and with better definitions of the purpose of science education, particularly education by means of botanical science, we need to consider our practises anew. If a prominent feature of reform is discontinuance of past vices, a feature of progress is discontinuance of past virtues for better and larger ones.

If the product of our botanical teaching does not meet our ideals, we should look for explanation to some or all of the factors or causes of the very complex situation which confronts us.

1. First, what are our ideals? What do we wish to accomplish through botanical teaching? Do we wish to use the study of botany as a means of developing on the part of the people in general a more dependable method of thinking, better reliance upon native powers of observation, experimentation and interpretation, an attitude that demands evidence before judg-

ment may be given, or do we wish to make knowledge of plant life, its structures, processes, habits and uses, the possession of the people in general in order that they may know more, enjoy more, or may more effectively adapt plant life to their economic uses? Do we wish to prepare students who shall take up research in botany to the end that unsolved problems may have solution? Or have we any definite purpose for botanical education other than that since botany is a field which we have found most interesting we wish to "pass it on" to others?

The ends which we seek certainly should receive the careful attention of all who are engaged in general botanical instruction. Research in botany is not the goal of general botanical education, and botany can not claim a place in the general curriculum of the high school or college if its primary aim is to prepare students for research in botany. On the other hand, research is perhaps the most important by-product of general botanical instruction, since when general courses of instruction are efficient there develop well-grounded students who desire to become investigators in the subject.

The purpose must be more serious than to give passing enjoyment, stimulate curiosity about plants, or to minister, as early botanists sometimes said, to the emotional nature of young ladies. There is great need of development of a rigorous scientific attitude toward plant phenomena. Plants and their products are our constant companions and there are certain fundamental facts and principles that people should know about them. If they learn these facts and principles in a way that develops care in observation, in experiment, and in proper thinking, I believe there is also secured enjoyment of plants and ability to make economic use of them. This central foundation in method and content should be best upon which to build research work. It would seem also that research would find a large number of worthy devotees if general courses of instruction were presented as broadly fundamental to the science, and more significant in practical affairs.

2. A second factor has to do with the quality and preparation of the students who present themselves in our college courses. From an amount of data too limited for final conclusion, it seems that most of the students who elect college courses in botany have had no botany in secondary schools. For some reasons, secondary school courses seldom lead students to take botany in college, or else college requirements prevent their doing so until they have become engrossed with other lines of work. Possibly the difficulty lies in inefficient courses or teaching in secondary schools. These courses have been accused of being too formal, too technical, too closely limited to a special field of botany, not sufficiently full of meaning to young students. Secondary courses in botany have also been accused of being too difficult —an accusation which I think is untrue. It is not, for example, the inherent difficulty of alternation of generations, but lack of any appreciable motive for studying it, which makes it seem difficult. The structure and workings of a steam engine or an automobile are more difficult, but they are "going things"—dynamic—and students solve their mysteries. If an appreciable motive is put into secondary teaching of botany its difficulties are solvable.

Possibly some of the difficulty lies in the fact that the different sciences are incoherent and intermittent in the high schools. In a valuable recent investigation made by an eastern biologist records were collected from 276 high schools. Botany is taught in 225 of them. It is distributed in the

different years of these high schools as follows: first year 76, second year 94, third year 26, fourth year 29. It is evident in so far as these and other statistics go, that something in the way of definiteness is beginning to appear as to the year in which botany is taught. But it is also to be noted that in these schools botany appears in almost every possible relation to the other sciences that are taught, and it is taught by teachers who teach almost every possible combination of subjects in the entire curriculum. The sciences need more of the same sort of consecutiveness that is found in the languages, if we are to develop more worthy scientific value.

Furthermore, from the above-mentioned investigation and others, it appears that the courses in botany vary in nature from systematic botany to a study of the anatomy and cytology which deal with plant evolution. Surely the courses in secondary schools need scientific study, unless it is true that there is no part of the subject and no particular organization that is best for the education of beginners. I believe we have a right to expect that a scientific organization of the science for the secondary schools, in addition to conferring better immediate results upon pupils, will lead more of the students who have done well in science to desire to continue these studies in college. This would be of great advantage, for we need more students who early in life have begun to *think botany* and to think in the scientific method.

The nature of the preparation of our graduate students is also a factor in our product. This varies largely. In at least some of the larger universities comparatively few of the graduates come from the local undergraduate body. They have for the most part had their training in the smaller colleges, and those who come to the university are of two classes—those who are called, and those who are sent. Some of them, through the more general courses of the smaller colleges, got their desire and enthusiasm for botanical investigation, and come to the university to continue that study. They are chiefly those who give us new botanical knowledge. Others, who have not secured suitable positions, come to the university and do graduate work as a means of securing better employment, and good botanists and good teachers sometimes develop from this group. A compelling desire to study botany is the motive most likely to yield results of high order.

3. Another factor in the efficiency of our student product is found in the nature and appropriateness of the courses into which these students go when they come to colleges. Whether research or teaching is the end to be secured, there are needed courses in the general fundamentals of plant life and structures, and in chemistry, physics, physiography and general physiology. Too early specialization is likely to produce a narrow research student, and to render a teacher unable to give to his students the necessary vitality in his introduction to general botany. In our revolt from the special field of systematic botany, botanists went to an extreme of even greater specialization, so that sometimes students in research in morphology are uninformed regarding the relationships of the particular plants with which they work. And so specialized are we at times that teachers in small colleges and secondary teachers who have had our so-called general courses must teach a special field of botany because they know no other. It is quite possible in some cases to go into a secondary-school class in botany and by observation of the nature of the teacher's work, to determine the university in which the teacher was trained. This, of course, is not an argument against research in which we all believe most pro-

foundly, nor against emphasis upon special lines of research in different universities, but is an argument against permitting that special research to dominate courses that presumably are for general education in botany. As Schleiden in 1849 organized the general field of botany as an inductive science, we again need for general students a presentation of the fundamentals of the science as a whole.

There are many other factors that have to do with the efficiency of the product of our botanical teaching. We need more students who in their latter college years have definite purposes in mind—as teaching, research, practise of forestry, agriculture, etc. Possibly our teaching ought to enable them to discover purposes that will absorb them as do other college interests.

More fundamental, however, is the fact that we have been too content to assume without sufficient data, and to dictate regarding the nature of the needs of general instruction in our subject rather than to make the same sort of investigation in the field of teaching that we should make in our botanical investigation. If we can devise methods of making a scientific study of botanical education, we can improve our student-product.

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III. Methods of Botanical Teaching

As a past master in the art of cooking botanical hares, Dr. Bessey has spent most of his time in elaborating the recipe. To me, however, the problem seems peculiarly one of making sure of getting the hare and then of keeping it long enough to cook it properly. As I see the problem, it seems almost imperative that the hare should be caught in the high school. The chief difficulty in our getting material for turning into young botanists lies at this point. High-school students, and especially the boys, are not attracted to botany; one might say they are not attracted by the kind of botany offered. More than that, and this may be the crux of the whole question, we fail signally to enlighten the parents of the boy as to the real meaning and place of botany. Botany will not attract the attention of the high-school boy unless it meets every-day conditions—unless it puts him in touch with his every-day environment in a way that is sympathetic as well as illuminating. Moreover, it is perhaps of equal importance to bring the public to understand what a fundamental place the knowledge of plants has in every-day life, and how important a part of education it is in consequence.

So far as the high school is concerned, we have the situation entirely in our own hands. Few of us can teach anything but what we have been taught, nor can most of us teach in any way but the one by which we have been taught. If you will look over the high schools of your state you will see that the kind of botany you are teaching is the kind of botany that is being taught in your high schools. It seems to me that few botanists realize this fact. It really means that we are actually teaching high-school botany to our beginners, for this is inevitably the botany that they will carry into the high schools. When we appreciate this fact thoroughly, we shall change our elementary teaching. When we do change it in a way to attract the sympathy of our students, then the problem of catching the hare, or at least of knowing the paths that he will follow, will be solved.

The next most advantageous point for catching botanical hares is upon entrance to college. This last year, in the University of Minnesota, the College of Arts graduated 265 bachelors—most of them maids. There were 195 of the latter and only 70

men. Out of the 265, thirty-five had taken a major in science; for many of the thirty-five, this meant but three courses in science during the whole college course. This tells definitely, it seems to me, of our failure to attract freshmen to science. This failure is largely our own fault. It is the failure of botany to provide a definite avenue to a position, such as is offered by courses in law, medicine, engineering, agriculture and forestry. The boy does not enter botany, because he knows of no such opportunity in it. There is no definite course set forth in the catalogue for the training of professional botanists, such as we find everywhere in colleges of agriculture, engineering, etc.

Our second failure, and the most significant one, it seems to me, is to hold our hare long enough to make a plausible instructor of him—to make even the beginner that Dr. Bessey has in mind, one who knows enough to find out what he must do to learn how to bud pecan trees. It seems to me the signal failure we are all guilty of in teaching elementary botany is the failure to catch the students' point of view—of realizing that it is what the student needs and likes in his own peculiar environment that must determine the method of teaching and the matter that we use. I can not see that the materials for our courses should be assembled, as they have been, from the standpoint of the professor, upon the obvious assumption that what the professor likes to teach the student is the best thing for him to learn. This seems to me the chief reason why we fail to hold students in any considerable number for advanced work. Naturally, this does not apply to the two or three universities which attract students from all over the country for graduate work. It concerns the majority of botanical departments, however, in which the hope of advanced students must be realized chiefly from the beginning classes.

To become concrete, it would seem that the microscope is responsible to a very large measure for our difficulty. No hard-headed boy of freshmen age expects to carry a microscope around in his pocket throughout his life. He is interested in things that go and things that work, and I believe that we shall get his sympathy and interest and succeed in holding him for advanced work only as we give him what he wants and needs in this respect. Last year a freshman girl opened our eyes somewhat more widely on this very point. She was working with the germination of seeds in the greenhouse; after describing the steps in germination, she added naïvely as an afterthought, "the seeds we worked with were real peas such as you see on the table." The microscope has made the student feel that he is dealing with an unreal world, and that the plants we use in botany are none of them of the least importance in every-day life. Not only is the microscope far too special an instrument for the beginner, but this specialized tendency also permeates nearly all elementary botanical teaching. I recently encountered a sentence which will illustrate this fact. It is taken from a book which "is addressed to pupils in their first or second year in the high school." The sentence is the following:

> The change from free parts of hypogynous flowers to union of parts as shown in perigynous, epigynous, epipetalous, sympetalous and synsepalous flowers, reaching the climax in the composites.

I find it difficult enough to get such ideas into the heads of college sophomores, with any real understanding of their meaning. In the case of high-school students, it indicates clearly that we are shooting far over their heads. While I admit that a good drill-master can make a student memorize

a statement like this, I feel that it is practically impossible to give him any real understanding of the many concepts in it, in any beginning course. We succeed in making our beginners feel, as a consequence, that botany is nothing but a lot of long hard names.

Now what is the remedy for the dearth of advanced students? In the first place, I recognize fully that we will hold students for advanced work only as we gain their interest and sympathy in the general courses. The test of our general courses in college botany must be—what does the student need, and what must he use in every-day life. To many of you this practical outlook upon the subject seems to be in conflict with what we call a scientific presentation. To me, scientific botany means presenting the important facts about plants from the standpoint of their every-day behavior and use, in a thorough, accurate and systematic fashion. While it is a time-worn truism to say that we must proceed from the known to the unknown, yet we must realize that no one ever succeeded in learning in any other manner. We must take the student in his every-day plant environment, set him to work puzzling about it, and point out the way by which he can solve his own puzzles. I think it is as unfortunate as it is illogical, that our education should be built upon the assumption that the early years are for memorizing, and the later years for reasoning. Until parents and teachers have stifled the spirit of curiosity, which is only the research spirit in an earlier form, the child is constantly reaching out for new experiences, asking endless questions, and taking endless clocks and dolls to pieces. I will admit that this spirit of inquiry has almost disappeared by the time the student enters college, but it can be fanned into an active flame again in many cases. Still more important than this, however, is to find a way to keep it alive.

For the most practical of all remedies, we must give our attention to the difficulties arising out of the fact that the school year runs the wrong way around. If the student is to deal with live plants, with plants as agents and materials in every-day life, as he must to be interested and benefited, we must realize that these things can be obtained only by the most careful planning. We must not only find means for stretching the plant season at both ends, in the spring and in the fall, but much more important still, we must confront the fact that beginning botany can not be properly taught without adequate greenhouses, as well as gardens. The greenhouse means constant contact with the most interesting and the most useful plants throughout the whole school year. It lends itself readily to the task of bringing the student into touch with the uses and applications of plants in a natural way. Indeed, the most indispensable feature of real botanical study, that of independent first-hand work with the living plant, is hardly possible without adequate greenhouses. The every-day relations between man and plants are of vastly more importance than all of the other things that we teach under the name of botany. They will not only crowd to overflowing the two years of beginning botany, but they will fill up a large part of the advanced courses.

One of our most signal failures arises from our feeling that a record in the form of drawings or notes constitutes knowledge—that the record indicates that the student really understands what he is recording. Nothing is further from the truth, as a rule. The record has no value; indeed, it rather does harm, except to indicate to what extent the beginner observes correctly and thoroughly. As something to be

crammed for quiz or examination, it is downright pernicious; hence the formal record should be reduced to a minimum, and the real emphasis laid upon first-hand contact with live plants, correct and thorough observation, and independent reasoning.

Again, as botanists familiar with an enormous amount of detail, we try to make the college course in botany cover just as many things as possible. One can admit that it should do this in so far as it can, and still realize that it can do this in only a small degree. Nearly every course, and every text-book without exception, contains several times as much matter as the student can assimilate. Indeed, if we remember that we ourselves learn little except by experience and experiment, we shall see that this must apply much more forcibly to beginners in botany. For this reason I do not believe in text-books, or in lectures in any general course whatsoever; I would have none of them. This no longer seems to be a mere opinion, but the logical conclusion from actual and definite experiments in teaching botany. Listening to talks about plants can not lead to real learning in any sense of the word, and reading about them is in some respects worse rather than better, so far as the beginner is concerned.

I would replace text-book and lecture wholly by first-hand contact with plants. I would do away with all set quizzes and examinations, and make the student face the test of his work just as often as he faces the work itself. Moreover, even by this method, students can learn little by single contact. To take up a plant or a function or a structure once, and then to leave it, not only wastes time, but it also fixes an unfortunate habit. A tandem arrangement of materials and courses can never give the beginner real understanding. Every course should telescope the one before it, touching the major points again and from different angles, broadening and deepening the student's knowledge upon a sure foundation, not upon the mere assumption that he recalls or understands anything that he has had.

To some teachers the universal remedy for lack of knowledge or understanding on the part of the student is what is called the intensive course. The latter has certain apparent advantages. One covers more ground, without question, and the student's handling of the subject matter seems a little more certain. The real test of an intensive course, however, can be made only by unexpected quizzes at intervals of a month or two after the course has been completed. Any one who applies such a test to an intensive course will need no further argument in regard to it. One who has applied such a test can not feel like giving any more time to discussing its value.

I wish to emphasize the point Dr. Bessey has made as to the need of using young botanists just as early as possible. We are now trying out a plan by which sophomores, who plan to specialize in the subject, are put in charge of small groups of freshmen in greenhouse work. The plan during the first year has proved much more successful than we anticipated, and it will be extended just as rapidly as possible. It has been a splendid thing for the sophomores, and it has not proved fatal to the freshmen.

I can not close without pleading that we make the teaching of botany a matter of experiment. We should be ecologists who study the student, the method, the matter and the results, both as to knowledge and to training, in an exact, quantitative manner. If we do this, we shall get rid of our loose opinions that for the beginner in bot-

any any method is as good as any other method, and that the results must be good because *we* have done the work. I feel sure that the use of experiment in connection with our methods of teaching, and the measurement of results will go a long way toward changing our present methods and improving upon our present results.

F. E. Clements
University of Minnesota

Discussion

Professor John M. Coulter, University of Chicago:

As Dr. Bessey says, some of us began botany a good while ago, when facts were so few that they were pieced out with enthusiasm, and our knowledge of the subject was chiefly enthusiasm; but now the facts have multiplied so enormously that it is a problem how to present them.

I have been in discussions of this kind for a good many more years than I should like to acknowledge. They have all sounded alike to me, but the thing I learn from them is this: that no matter how much thought we give to the technique of teaching botany, or how many devices we suggest as to methods of presenting it, a gratifying group of successful botanists continue to surmount all the obstructions we manage to place in their way. My definition of a successful teacher has long been one who places the fewest obstructions in the way of the student.

It is clear that we must encourage independence and originality in our students if they are to become investigators or only teachers. This attitude is appearing in the teaching of botany, for teachers are becoming more independent, and are thinking more for themselves. No teacher, however successful, has the right to prescribe for others a detailed method of teaching. It is only a stupid teacher who copies some other teacher. Every one must have his own way, and if the text-book is the only way for him, let him use it; if he can do better without it, let him throw it away.

In brief, the problem is this. We are confronted by all sorts of suggestions as to teaching. Our subject has grown to be so vast and is still growing so rapidly that we know not how to deal with it in detail. There are just two general things that a teacher must keep in mind, and the details can be left to shift for themselves.

In the first place, there must be developed a general perspective of the subject. It is a vast plexus, and each of us in his own individual way must develop for the student some conception of the extent and interrelationships of this plexus we call botany, so that he may leave us with no narrow vision.

In the second place, in addition to the perspective, there must be developed what we call the scientific method, which is a certain attitude of mind. This is absolutely fundamental. There are many ways of doing this and every teacher has his own way of enforcing the training that demands the truth, and knows what it takes to reach the truth.

It is my conviction that any one cultivating this perspective and this scientific attitude of mind, by whatever detail of method they have been reached, is likely to prove successful in any form of botanical activity, whether it be teaching or investigating, with the scientific motive or with the practical motive. The details have become too numerous to include in instruction, but it will always be possible to train a spirit that will be able to master any details.

Professor F. C. Newcombe, University of Michigan:

I will say that I feel considerably cheered up since the last two addresses. No doubt

the rest of you, or some of you, feel the same way. I was beginning, a few minutes ago, to congratulate myself that such instruction as I had received was received twenty-five years ago instead of at the present time, because I know that if it had been received at the present time I could have become nothing but some poor ignoramus.

First of all, I should like to refer to some of the ideas presented here this evening:

Professor Bessey stated that our students in the university are looking here and there without reference to any aim in life, and I wondered whether he had actually looked into the matter of student elections in his university, where elections have been quite free, as they are in the university with which I am connected, or whether he has been seriously investigating this subject. The matter has been looked into in my university, and there it is found that more than 80 per cent. of the students who have perfect freedom in elections have elected with some aim. There is a comparatively small percentage of students who are browsing around without taking any direction.

The second thing that Dr. Bessey says is that he is trying a system of instruction in his university of 20 to 25 hours in botany as preparation for a college or university instructorship. That is the minimum we in Michigan think the average student should have for preparation to teach botany in the high school.

It was said a few minutes ago by Dr. Coulter that it is not a matter of the number of hours the student spends on a subject, but it is the ability which the student develops for doing things, his attitude, his efficiency, his originality, that makes him able to advance. I had some years ago a student who took only one year in botany. She was a teacher, and she had been teaching for some time, and I gave that woman the strongest recommendation of any woman who went out that year. She had only one year, and yet she was ready. It is not how many courses the student has, it is a matter of the student's ability to take new ground, to start in a new direction and develop the subject for himself.

On the side of research, I can not help placing in contrast to the quantity of preparatory work which some of us think we must have from our students before coming to research, that well-tried system in the German universities with which you are all familiar, and which reduces the number of students to a few successful ones by the law of survival of the fittest. You know that, in the German universities, the student takes perhaps on the average not more than one year in elementary botany, and is then allowed to go along for a few weeks, or possibly a semester with a *Vorarbeit,* and is then thrown mostly upon his own resources for investigation. There are many successful botany teachers and investigators who come out of that sort of training. I wouldn't advocate that sort of training in this country; but I think there is danger of our overdoing the matter in endeavoring to give the student something of all kinds of knowledge in botany. If the student is fit for any kind of teaching after he has had proper training in some lines of work he will be able to work out something for himself that he may not have been trained for in the schools.

It was stated here also in one of the addresses that the aim of general education is not for research. I think that statement was made. I would not say that one aim of general botanical education is not for research. What have we been talking about and hearing about in this session of scientific societies in Minneapolis? We have been hearing of the need of the in-

vestigation of plant physiology, of phytopathology, of the study of all things that are related to the welfare of the people of this nation and of the world. Now, if it isn't the university's business to prepare men for research, I should like to know where that business does lie.

It seems to me we have a double duty—we must provide teachers and we must provide investigators. The university's function is just as much for research as for instruction. The staff should be just as much bound to the doing of research as to the giving of instruction, and just as much bound to train the young people under them for research as to train them for teaching. We need both. We need research just as much as instruction.

Now, is it true, as was stated here, that there is no open door to a career in the study of botany? It was said of law, medicine, etc., that there is an open door. But at the present time we can say to the student, there is also an open door in the study of botany. What does it mean when Dr. Bessey says they can not supply the demand? We have all of us felt that same thing. It means that, although the remuneration is not adequate in many directions, still there is the open door toward the earning of one's livelihood at least.

Now, to take up quite a different matter, and that on the main subject that this discussion opened with: that is, the question as to why we do not have more students becoming professional botanists. That's what the meaning is, I think, of the question as it was put. Now, the case is not so bad as has been presented here. If you will pardon me, I will review the relations at our own institution. We have no agricultural college at the university. We have a first-year class of 200 students—I think 194 this year; we have, besides that, in our classes above the freshman year, 175 students. Now, that proportion does not seem to me to be bad at all. We have our advanced classes with ten students, fifteen students, one class with thirty-two students, another one, second-year students, or mostly of second-year students, with fifty-five, and to my mind the proportion is not bad and it does not call for any great alarm as to the future. I expect in the future that the proportion of students in the advanced class will tend to increase instead of diminish. I don't see why it should not.

I find the method of encouraging the promising student to go on with the work is justified. We all make mistakes, but nevertheless we can, with ordinary good judgment, read the case right four times out of five, and perhaps more often than that, and I have found that by advising with those who attract attention as capable students, one can usually find several who can be led, without very much persuasion, in the direction of becoming professional botanists. One thought that is on a different matter. I have been considering for two or three years whether, as teachers of high-school teachers, we ought not to change somewhat—I know it is already done in Minnesota—whether some of us ought not to change our methods so that the perspective of the high-school teacher is brought more into relation with his subject matter as it occurs in nature. Of course a great deal can be done by greenhouse study; but after all that does not take altogether the place of field study, and I believe we must draw these teachers to field study so that when they go out to teach botany in the schools they may show their pupils the way by which they can in themselves carry the work further than it is carried in the schools—the high schools and lower grades.

I would like to see a set of statistics from

which I could ascertain how many of the professional botanists—those who have passed out from under our hands within the past ten or fifteen or twenty years, or longer—how many of these were young investigators before they went to the high school. I will venture to guess that I could pick out in this room fifteen or twenty of the men who sit right here whose youth I know something about, who made collections of plants and insects and hammered up rocks to get the fossil shells out of them before they went to the university or came within three or four years of it.

If statistics should bear out my belief, we should find that most scientists are so born and not given their bent by training, and that the few turned by training in the direction of professional science are thus influenced by the teacher who knows how to make the student an investigator at the same time he is pupil.

LEONARD P. KINNICUTT

IN the issue of SCIENCE of February 17 there appeared a brief notice of the death of Professor L. P. Kinnicutt, director of the department of chemistry in the Worcester Polytechnic Institute.

Leonard Parker Kinnicutt was born in Worcester, May 22, 1854, the son of Francis H. and Elizabeth Waldo (Parker) Kinnicutt. He received his early education in the schools of Worcester, graduating from the high school in 1871. He went at once to the Massachusetts Institute of Technology, where he devoted himself chiefly to the study of chemistry. Following his graduation, in 1875, with the degree of bachelor of science, he spent four years in professional studies in Germany. At Heidelberg he came under the inspiring influence of Bunsen from whom he acquired an appreciation of the value of careful and accurate analysis. Here also under Bunsen's guidance he was initiated into the refinements of gas analysis. This was the period when organic chemistry was developing with tremendous rapidity especially in Germany. Bunsen had passed the zenith of his career and was not in sympathy with the new tendency which was manifesting itself in chemistry. It is not surprising then to find the young Kinnicutt leaving Heidelberg and matriculating at Bonn. Only ten years before, Kekulé had been called to the University of Bonn to take charge of the newly built laboratory, which at that time was the finest in all Germany and after which later laboratories were patterned. Kekulé's was a charming personality. His lectures were a model for simplicity of arrangement and clearness of presentation, and the experimental demonstrations were carried out with such fascinating ease and dexterity that the young Kinnicutt was captivated by the spirit and beauty of organic chemistry and devoted himself diligently to its study.

He was fortunate in being accepted into the private laboratory of the master, where he became associated with Richard Anschütz, the present director of the Chemical Institute at Bonn. In collaboration with Anschütz he published a number of papers, chiefly on phenyl-glyceric acid. This association ripened into a lasting friendship. Returning to the United States in 1879, he spent a year in study with Ira Remsen at the Johns Hopkins University, and then three years at Harvard, where he served as instructor in quantitative analysis and as private assistant to Wolcott Gibbs, at that time Rumford professor of chemistry. In 1882 he received from Harvard the degree of doctor of science and in September of the same year accepted an appointment as instructor of organic chemistry at the Worcester Polytechnic Institute. In the following January he became assistant professor of chemistry; three years later he was made full professor, and since 1892 has been director of the chemical department.

As early as 1885 Professor Kinnicutt began to give attention to the question of sewage disposal and sanitary problems. He became an authority on the sanitation of air, water and gas; on the methods of analysis and on the disposal of wastes. He paid particular atten-

tion to the examination of water and watersheds and the contamination of rivers and ponds by trade wastes and sewage. He made numerous reports, both as regards private and public water supplies.

He visited England on an average every other year since 1894, familiarizing himself with the work done in that country and the results were embodied in various articles which he published on the subject. He paid special attention to the subject of the pollution of streams by wool-washings, and made a careful study of this problem at Bradford, England, where a greater amount of wool is washed annually than in any other city in England or in this country.

He was employed as an expert in numerous cases regarding the pollution of streams and ponds, and was one of the experts in the case of the pollution of the Mississippi River at St. Louis by the sewage of Chicago. In 1903 he was appointed consulting chemist of the Connecticut Sewage Commission, a position which he retained up to the time of his death. He was a frequent contributor to scientific periodicals and the proceedings of learned societies upon topics relating to his specialty.

In 1910, in collaboration with Professor C. E. A. Winslow, of the Massachusetts Institute of Technology, and Mr. R. Winthrop Pratt, of the Ohio State Board of Health, he published a book entitled "Sewage Disposal" which is considered to be one of the best treatises on the subject of sewage disposal in the English language.

Professor Kinnicutt's reputation was not confined to this country. He enjoyed a wide acquaintance, both in England and on the continent, and possessed the rare faculty of keeping ever fresh and active a friendship once established. One of his highest honors was the appointment as president of the Section of Hygiene of the International Congress of Applied Chemistry, which is to be held in Washington and New York in September, 1912. Even to within a few days of his death he continued to work with characteristic zeal in perfecting plans for the success of the section over which he was to preside. Professor Kinnicutt was deeply interested in the sanitary problems of his native city, Worcester. He kept a careful watch upon the city's water supply. During the "water famine" of the present winter, from his sick-bed he directed the tests to be made, had daily reports brought to him and outlined the policy by which, in his opinion, the city's health might be best safeguarded.

He devoted a great deal of time and money to secure a pure milk supply in summer for the babies in needy families, and at the time of his death he was a member of the Worcester Medical Milk Commission, which is investigating the question of pure milk for the city. Professor Kinnicutt was widely connected with scientific associations; he was a fellow of the American Academy of Arts and Sciences; a fellow of the American Association for the Advancement of Science, of which he was vice-president in 1904; a member of the American Chemical Society, and president of its Northeastern Section in 1902, and councillor for a succession of years; a member of the Society of Bacteriology; a fellow of the New England Water Works Association; of the Boston Society of Civil Engineers; of the American Antiquarian Society, and of various foreign associations, including the Association of Managers of Sewage Disposal Works of England, the London Chemical Society, and the German Chemical Society. He was a member of several social clubs in Worcester and Boston and retained to a remarkable degree his interest in the alumni reunions of the Massachusetts Institute of Technology, of the Johns Hopkins University and of Harvard University, and he rarely failed to be present and add his geniality to the general good cheer.

Esteemed and honored by the scientific world, and beloved by a wide circle of acquaintances, yet it was as a teacher that the true worth of his character manifested itself. Possessed of a broad training and knowledge of his subject, and a fund of personal experiences, with which he punctuated his lectures, he was enabled to drive home the truths which he desired to impress on the minds of his stu-

dents. Interest in his students, however, did not cease with the lecture or the laboratory. He was ever ready to listen sympathizingly and indulgently to those students who were in distress, and to all such he gave liberally of his time and purse. This conscientious devotion to duty and unselfish human interest endeared him to the students and alumni. It came as a great shock to all when, after a delightful summer of European travel and the resumption of his academic duties, apparently in his usual good health, he was attacked by a slow fever which confined him to the house after but a few days of activity. The trouble was diagnosed finally as tuberculosis. He received his first warning that he had this insidious disease in his system when he was a student in Germany, but had apparently fully recovered from this earlier attack. It was hoped that a year's leave of absence and careful nursing would restore him to health and the resumption of a part at least of his former activities. Toward the end of January, however, his heart became seriously affected, and he failed rapidly until the end came peacefully on the morning of the sixth of February.

Professor William T. Sedgwick, a lifelong friend and one of the pallbearers at his funeral, paid a fitting tribute to his memory when he said, "His was a unique, lovable and altogether charming personality. Kindness and friendship such as his life exemplified could no further go. He was critical, yet just; fearless yet considerate of others; honest to a fault; a hard worker; and to a degree nowadays unusual, an accomplished and cultivated gentleman."

W. L. JENNINGS
WORCESTER POLYTECHNIC INSTITUTE

HENRY PICKERING BOWDITCH

THE following memorial note on the life and services of Professor Henry P. Bowditch has been prepared for the American Physiological Society by a committee of its members:

At the death of Henry Pickering Bowditch there passed away a man who had notable influence on the development of medical and biological science in America. He was born in Boston, April 4, 1840, and was graduated from Harvard College in 1861. As a graduate he began the study of chemistry in the Lawrence Scientific School, but left, in November, 1861, to become second lieutenant in the First Massachusetts Cavalry, then starting for the front. After loyal and chivalrous service to his country during the remaining three and a half years of the Civil War, he resumed his studies in Harvard University and received, in 1868, the degree of Doctor of Medicine. Thereupon he went to France and Germany to learn from the masters of his chosen science, physiology, the aims and methods of research. Filled with the spirit of Bernard and Ludwig, he returned to the Harvard Medical School in 1871, and established the first American physiological laboratory for the use of students, a laboratory which soon proved hospitable to investigators in every phase of experimental medicine. For thirty-five years he was an energetic and inspiring teacher, and a leader in investigation. His studies of the peculiar functions of cardiac muscle, the indefatigability of nerves, the knee-jerk and conditions affecting it, the force of ciliary activity, and the growth of children, illustrate the range and originality of his researches. Apparatus invented by him and widely used in physiological laboratories attest his mechanical ingenuity. He was one of the founders of the American Physiological Society and was its second president. The traditions of the society, particularly its character as an association to encourage research, are largely the result of his initiative. His example and his genuine appreciation of new work as it was reported at meetings of the society were a wholesome stimulus to young men beginning physiological investigation.

To the larger interests of medicine he rendered important service by promoting reforms in medical education, notably by advocating and helping to introduce the four years' required course, and later by strongly urging greater freedom of election in medical study. The Harvard Medical School he served as Dean for a decade of important growth, and the development of the school will long con-

tinue in directions which his wisdom foresaw. Among the most valuable of his activities was his repeated defense of animal experimentation against unreasonable legislative restrictions, an activity in which he secured victories likely to preserve freedom of medical research for many years to come.

The honors received by Dr. Bowditch were many. He was a member of numerous learned societies in this country and abroad. He was a doctor of science at the University of Cambridge, and a doctor of laws at Edinburgh, Toronto, Pennsylvania and Harvard. In 1900 he was president of the Triennial Congress of American Physicians and Surgeons.

With sure and sober judgment Dr. Bowditch combined vigor and readiness of action which made him a natural leader. He was a never-failing source of stimulation and encouragement to all progressive movements aimed at professional and civic improvement, and his mind was fertile with ingenious and effective ways to secure the accomplishment of worthy ends. These qualities of leadership were combined with other qualities—keen interest, unfailing courtesy, fairness and good will—that won for him not only the friendship and lifelong devotion of the foremost men of medical science in this country and abroad, but also the affection of his students and close associates. From the days of his youth, when he began the struggle for ideals, to his last years of failing strength, he met what life brought him with courage and cheerful humor; and he passed away as much loved for the beauty and strength of his character, as he was admired for his achievements.

S. Weir Mitchell,
Russell H. Chittenden,
William H. Howell,
Walter B. Cannon

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The council met at the Cosmos Club, Washington, D. C., on Tuesday, April 18, 1911, at 5 P.M.

Mr. Minot reported the following from the Committee on Policy:

1. To recommend to the council that it look with favor upon the holding of a Pacific Coast meeting in the summer of 1915 and of extending this meeting to the Hawaiian and the Philippine Islands.

2. To recommend to the council that it (the council) recommend to the next general committee that the meeting of 1913–14 be held at Atlanta, Ga., postponing the proposed meeting at Toronto until a later year.

The council adopted the above resolutions.

The secretary of Section I reported nominations of officers for that section as follows:

Vice-president and Chairman—Oscar P. Austin.
Secretary—Seymour C. Loomis.

These nominees were elected.

On motion by Mr. Cattell, the permanent secretary was instructed to inform the officers of the societies usually meeting with the American Economic Association that the American Association would view with pleasure closer relations between this association and these societies and would be glad to have them represented upon our council.

The permanent secretary made announcement as to the preliminary work which has been accomplished so far by the local executive committee for the Washington Meeting.

It was suggested that it would be advisable to instruct the secretaries of the sections, prior to the long vacation, concerning the general interest sessions.

Messrs. Minot and Welch were appointed as a committee of the council to ask President Taft for some official recognition of the coming Washington meeting.

SCIENTIFIC NOTES AND NEWS

At the meeting of the National Academy of Sciences on April 20, the following were elected to membership: Edward Emerson Barnard, astronomer, Yerkes Observatory, Williams Bay, Wis.; Edward Burr Van Vleck, professor of mathematics, University of Wisconsin; John Fillmore Hayford, director of the College of Engineering, Northwestern University; Edwin Herbert Hall, professor of physics, Harvard University; Julius Oscar Steiglitz, professor of chemistry, University of Chicago; Bertram Borden Boltwood, pro-

fessor of radio-chemistry, Yale University; James Furman Kemp, professor of geology, Columbia University; Arthur Louis Day, director of the Geophysical Laboratory of the Carnegie Institution; Robert Almer Harper, professor of botany at the University of Wisconsin. Foreign associates were elected as follows: Professor Ernest Rutherford, University of Manchester, England; Professor Vito Volterra, University of Rome, Italy. At the annual dinner of the academy on April 19 the Draper Gold Medal was presented to Mr. C. G. Abbot, of the Smithsonian Institution, for his researches on the infra-red region of the solar spectrum and his accurate measurements, by improved devices, of the solar "constant" of radiation.

DR. ALEŠ HRDLIČKA, of the U. S. National Museum, has been made a corresponding member of the Société des Americanistes de Paris, and a foreign associate of the Società Italiana d'Antropologia.

DR. J. S. FLETT has been appointed to succeed Dr. J. Horne, F.R.S., as assistant in Scotland to the director of the Geological Survey.

MR. FRANK M. CHAPMAN, of the American Museum of Natural History, has sailed from New York for Colombia, South America, where he is to join Mr. William B. Richardson, who has been in that locality collecting birds and mammals for the museum for several months. Mr. Chapman expects to get into a region where no collecting of birds has been done; there he will make a systematic survey, probably obtaining some undescribed species and many new to the museum collections. He will also get material for several new bird groups. He has taken an assistant and expects to remain until July, when Mr. Richardson and the assistant will continue the work.

DR. ELLSWORTH HUNTINGTON, of the geographical department of Yale University, is at present making explorations in New Mexico. Mr. Huntington is making his headquarters temporarily at Sante Fé in the old governor's palace, now used as the Museum of the Archeological Institute of America. The field of exploration will cover the old Pueblo ruins and cliff dwellings.

MR. W. A. ORTON, pathologist in the Bureau of Plant Industry, Washington, sailed on April 22 for Hamburg, and will spend six months in the study of plant diseases and the sugar beet industry in Germany, Austria, Russia, France and England. He will attend the fourth International Conference on Genetics at Paris and present a paper entitled "The Development of Disease-resistant Varieties of Plants."

DR. YANDELL HENDERSON, of Yale University, is to make, during the coming summer in company with Drs. Haldame and Douglas, of Oxford University, an extensive exploration around Pikes Peak, for the purpose of studying the effects of high altitudes on men and animals.

PROFESSOR EDUARD SELER, of Berlin, on leave of absence in Mexico, has discovered a set of ancient paintings on the walls of one of the apartments of the Palenque Palace.

THE Prince of Monaco has appointed as members of the first council of the new Institute of Human Paleontology in Paris: MM. Salomon Reinach, Boule, Berneau, Cartailhac, Capitan, Villeneuve, for France; Sir Ray Lankester for the British Isles; Professor von Luschan for Germany; Professor Hoernes for Austria-Hungary; Professor Issel for Italy, and Professor G. Retzius for the Scandinavian countries.

DR. A. E. KENNELLY, of Harvard University, has accepted an invitation from the University of London to deliver a short series of lectures in London, at the end of May next, on "The Application of Hyperbolic Functions to Electrical Engineering Problems."

PROFESSOR FRANCIS E. LLOYD, of the Alabama Polytechnic Institute, has recently lectured before the staff and students of the departments of botany and zoology of the Johns Hopkins University, on "The Behavior of Tannin in Persimmons during Ripening."

ON the evening of April 10, Dr. Wallace W. Atwood, of the University of Chicago, gave an illustrated lecture before the Geographic So-

ciety of Chicago on the "Mesa Verde National Park." It was a geographic study of the home of the cliff dwellers.

A recent meeting of the New York Academy of Medicine was devoted to addresses commemorative of the life and work of Dr. Edward G. Janeway. Dr. Francis Delafield spoke of him as the "Physician"; Dr. William H. Welch as the "Pathologist"; Dr. Abraham Jacobi as the "Consultant," and Dr. Joseph D. Bryant as the "Colleague and Friend."

At the coming meeting of the Medical and Chirurgical Faculty of Maryland, portraits will be presented of the late Dr. Francis Donaldson by Dr. William H. Welch and of Dr. Charles M. Ellis, Elkton, by Dr. Lewellys F. Barker.

English journals announce the death of Mr. Charles du Bois Larbalestier, a leading authority on lichens, to whom the last edition of Leighton's "Lichen Flora" was dedicated; and of Mr. J. S. Slater, for many years principal of the Civil Engineering College, Sibpur, near Calcutta.

The United States Civil Service Commission announces an examination to fill four vacancies in the position of forest pathologist in the office of Investigations in Forest Pathology, Bureau of Plant Industry, Department of Agriculture, at a salary of $1,800 to $2,400 per annum. It is expected that the persons appointed to these positions will be assigned for the greater part of the time to duty outside Washington, in charge of branch offices. Applicants will be required to show that they have had a broad scientific training, as well as considerable successful experience in technical or executive capacities. It is also desirable that they have training in plant pathology and botany equivalent to that required for the Ph.D. degree. The examination is open only to men, and competitors are not required to appear at any place for examination.

Beginning on July 5 and continuing during the months of July and August, the facilities of the Seed Laboratory of the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C., will be available, as far as space permits to any one wishing to become familiar with the practical methods of seed testing. There will be an opportunity to observe the laboratory methods of testing for germination and mechanical purity, including the recognition of crop seeds and the commoner weed seeds.

The *British Medical Journal* states that the first meeting of the International Committee of the seventeenth International Medical Congress would be held in London on April 21 and 22. The president of the committee is Dr. Pavy; the general secretary, Dr. Burger, of Amsterdam, and the members are Professors Waldeyer and Posner, representing Germany; Genaro Sisto, Argentina; von Eiselsberg, Austria; Déjace, Belgium; Rousseff, Bulgaria; Rovsing, Denmark; Ruffer, Egypt; Recasens, Spain; Musser, United States; Blondel, France; Kalliontzis, Greece; Koloman Müller, Hungary; Maragliano, Italy; Kitasato, Japan; Fonck, Luxemburg; Uchermann, Norway; Pel, the Netherlands; de Mattos, Portugal; von Ott, Russia; Subbotic, Servia; Henschel, Sweden; Cérenville, Switzerland. In addition to these, the following are members of the committee: Dr. von Grosz, of Budapest, as general secretary of the previous congress; Sir Thomas Barlow and Dr. W. P. Herringham, of London, as president and general secretary respectively of the forthcoming congress, and Dr. Lucas-Chàmpionnière, of Paris, as president of the International Medical Press Association. The committee will have brought before it for approval the resolutions passed by sections of the sixteenth congress. It will also consider the date of the eighteenth congress, arrange the number and nature of the sections, and discuss a general regulation as to the organization of the congress and its position in regard to international specialist and national congresses. In this connection the general secretary of the committee, Professor Burger, will present a report on a series of proposals made by Professors Waldeyer and Posner. We understand that a proposition will be made to the com-

mittee that the date of the congress shall be changed from July 29 to August 6, as previously fixed, to August 4 to 9, 1913.

THE local committee of the American Society of Mechanical Engineers, E. M. Herr, chairman, Elmer K. Hiles, secretary, having in charge the preparations for the convention of the society, which will be held in Pittsburgh, Pa., from May 30 to June 2, inclusive, has nearly completed the work of arranging the program for each day during the meeting. It has been settled that the arriving guests will be received and registered at the Hotel Schenley, the society headquarters, on Tuesday morning, May 30. In the evening there will be an informal reception for the members and ladies in the parlors of the hotel. The extensive alterations being made by the new management of the hotel will add very largely to the comfort and enjoyment of visitors during the convention. The professional sessions will be held in the lecture hall of the Carnegie Institute, near the headquarters, Wednesday morning and evening, Thursday and Friday morning. In the meantime there will be a number of inspection trips to various industrial plants in the vicinty; a boat excursion for the members and ladies up the Monongahela River, a reception and ball at the Hotel Schenley on Thursday evening and, finally, on Friday evening, a smoker and entertainment, given by the Engineers' Society of Western Pennsylvania in their rooms in the Oliver Building. A carefully prepared program for the entertainment of the lady visitors has been arranged by a committee of ladies from Pittsburgh and vicinity, which includes a number of social functions. Judging from the number of inquiries, which have already been received from expected guests, a very large attendance is looked for, and everything indicates that this meeting in Pittsburgh will be one of the most successful "spring meetings" the society has ever held.

THE twenty-second season of the Biological Laboratory of the Brooklyn Institute of Arts and Sciences will be held at Cold Harbor, Long Island, from June to September. The regular class work will begin July first and continue for six weeks. The courses offered include field zoology by Dr. H. E. Walter, Dr. C. B. Davenport and Mr. Sidney I. Kornhauser; bird study by Mrs. Alice Hall Walter and Mr. G. Clyde Fisher; comparative anatomy by Professor H. S. Pratt and Dr. A. A. Schaeffer; general embryology and microscopic technique by Miss Mabel Bishop; cryptogamic botany by Professor D. S. Johnson and Mr. H. H. York; plant ecology by Professor Henry S. Conard and Miss Ruth Higley; beginning investigation in animal bionomics, evolution, cryptogamic botany and ecology by instructors in those subjects. A training course for field workers in eugenics is offered. Twenty scholarships are available for properly qualified college graduates with biological training who wish to prepare for positions as field workers in connection with institutions and hospitals. About two thirds of those receiving scholarships may look for appointments in such investigation. A biological club meets two or three times a week during the evening. One scholarship of a hundred dollars is available. The announcement of the laboratory may be obtained by writing to the director, Dr. C. B. Davenport, at Cold Spring Harbor, Long Island, N. Y.

ON April 11 Governor Tener sent a special message to the Pennsylvania legislature, recommending immediate legislation for control of the bark disease of the chestnut. A bill has since been reported providing for a commission to undertake this work, and carrying a total appropriation of $285,000. So far it is only the eastern and southeastern counties of Pennsylvania that are completely infected with this disease, and it is hoped, by the elimination of spot infections in advance of the line of general occurrence of the disease, to restrict its spread to this area. The great chestnut forests of the state which, according to the state department of forestry, have a total valuation of approximately $50,000,000, are still essentially untouched by the disease, and the great object of the proposed legislation is to save these. Experiments made by the national department of agriculture appear to have demonstrated practical methods of quarantine

against this disease; and Pennsylvania is the first state to undertake these methods on a large scale.

The Association of American Geographers will publish, beginning with this year, an annual volume to be known as the *Annals* of the Association. This will be devoted to the most important scientific papers presented at the anual meeting. The publication will be managed by a committee composed of Mr. Alfred H. Brooks, of the U. S. Geological Survey; Professor Henry C. Cowles, University of Chicago; Professor Ralph S. Tarr, Cornell University, and Professor Richard E. Dodge, Teachers' College, Columbia University.

The *British Medical Journal* reports that the principal centers in India in which plague occurred during 1910, and the deaths consequent thereupon, were as follows: Bombay Presidency, 36,831; Bengal, 30,546; United Provinces, 144,266; Punjab, 143,416; Central Provinces, 42,104; Rajputana, 37,657; Burma, 7,605. The following are the most recent general statistics: October 22 to 31, 1910, 5,641; November, 26,189; December, 39,604. Total deaths, 71,434, making, with deaths, July to October 22, 20,828, total for half year, July to December, 92,262. During the first six months of 1910 the deaths numbered 360,632. Total deaths during 1910, 452,894. It would appear that the recrudescence of plague in 1911 has begun in a more virulent form than in 1910. In January, 1911, the deaths from plague in India numbered 75,468. This is a higher figure than in 1910, when in January the deaths amounted to 51,437.

UNIVERSITY AND EDUCATIONAL NEWS

By the will of Henry F. Dimmock, of New York, Yale University will receive about $100,000 and under certain contingencies will receive twice this amount.

In addition to the regular course in general surveying, the School of Mines of the University of Arizona will start this year a summer school of mine surveying lasting through the month of June. This course, which will cover the details of underground surveying, the construction of stope plans and other allied subjects, will be conducted by Mr. Eugene R. Rice, engineer of the Hite Gold Mines, city engineer of Wickenburgh, etc. The work will be done in one of the numerous mines near Prescott, Arizona.

Dr. Arthur H. Wilde, who has been connected with Northwestern University, Evanston, Ill., since 1892 and has been secretary of the university council since 1909, has accepted the presidency of the University of Arizona, at Tucson, and will take up his duties there on May 1.

Dean Juliet Greer, professor of domestic science and art of the Oregon Agricultural College, announces her resignation from the position which she has held for three years, the resignation to take effect the coming July.

Richard Swann Lull, B.S., M.S. (Rutgers), Ph.D. (Columbia), assistant professor of vertebrate paleontology in Yale College and associate curator in the Peabody Museum, was made professor of vertebrate paleontology in Yale University at the corporation meeting of April 17. At the same meeting Dr. George Grant MacCurdy was appointed assistant professor of archeology. He is secretary of the American Anthropological Association and of Section H of the American Association for the Advancement of Science.

New appointments and promotions at Stanford University for the academic year beginning August 1, 1911, are as follows:

New Appointments:

Noah F. Drake, associate professor of economic geology. Dr. Drake is a graduate, A.B., A.M. and Ph.D., of Stanford University; professor of geology and mining in Imperial Pei Yang University, Tientsin, China, since 1898.

Mr. Henry V. Poor, instructor in graphic art. Mr. Poor received his A.B. degree at Stanford, 1910, and is now studying abroad.

Mr. Jesse B. Sears, instructor in education. Mr. Sears received the A.B. degree at Stanford, 1909; now instructor in the University of Wisconsin.

Mr. Harry J. Sears, Stanford, A.B., 1910, instructor in chemistry.

Miss Alice R. Berger, Stanford, A.B., 1908, acting instructor in chemistry.

Promotions:

Robert E. Swain, to be professor of physiological chemistry.

Lillien J. Martin, to be professor of psychology.

John O. Snyder, to be associate professor of zoology.

Percy E. Davidson, to be associate professor of education.

Rufus C. Bentley, to be associate professor of education.

LeRoy Abrams, to be associate professor of botany.

Clara S. Stoltenberg, to be associate professor of physiology.

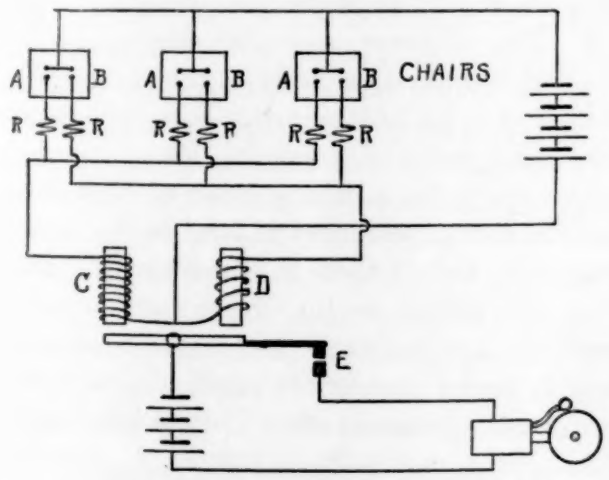
David M. Folsom, to be associate professor of mining.

Galen H. Clevenger, to be associate professor of metallurgy.

DISCUSSION AND CORRESPONDENCE

FACULTY BUSINESS ACCELERATOR

FOR the purpose of facilitating the despatch of business the following electrical device is suggested. The method of operation will be evident from an inspection of the diagram of the electrical circuits. All the chairs of the faculty room are fitted with electric circuits as indicated in the three chairs shown. Each chair has two switches; those indicated by *B* are automatically closed when the chair is



occupied; those indicated by *A* are push-button switches concealed on the arm of the chair to be closed by hand. *R, R, R,* etc., are suitable rheostats all of the same resistance. It is evident that when any number of chairs are occupied the combined current through the switches *B* will excite the electromagnet *D*. If the electromagnet *C* has twice as many turns of wire as *D* then, when a majority of those present at any meeting close the hand switches *A*, the magnet *C* will exert more pull upon the armature than *D*, thus causing the contact *E* to be closed and the bell to ring.

The apparatus is not intended primarily as a means of taking formal votes but as an impersonal means of calling for the previous question. In place of the bell it might be considered desirable to use an electric sign with the exhortation "*sit down.*"

S.

MUSEUM LABELING

ON the first two pages of the March issue of the *Museum News* of the Brooklyn Institute of Arts and Sciences are many ideas pleasing to those interested in museum labeling. These stand out in contrast to some ideas with which museum men in this country, especially during the last decade, have been overwhelmed. The art of label writing, as there stated, is truly a gift. Many people fail to understand this and few realize that one must sometimes let an unsatisfactory label stand for a time, just as a minister sometimes preaches a poor sermon.

The *Museum News* is almost an ideal example of what a museum newspaper should be. It is dignified, conveys not only interesting but true information and also has a distinct tendency to cause the reader to wish to help not only the museums of Brooklyn, but the museums of the country.

HARLAN I. SMITH

WILKES'S ANTARCTIC DISCOVERIES

TO THE EDITOR OF SCIENCE: The *Zeitschrift* of the Geographical Society of Berlin recently published a short notice[1] or review of my article "Why America should Reexplore Wilkes Land."[2] The reviewer finds fault with the article and attempts to straighten it out in the following words:

[1] *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, 1910, No. 7, p. 469.

[2] *Proceedings American Philosophical Society*, Vol. XLVIII., 1909.

Für eine kräftige Wiederaufnahme antarktischer Forschung, und zwar in Wilkes Land durch Nord-Amerika tritt Edwin Swift Balch mit Entscheidenheit vor. Seine einschlägigen Darlegungen aber leiden durch die gänzlich ungerechtfertigte Annahme, dass die früheren Arbeiten der Nordamerikaner nicht nach Gebühr geschätzt, und in England ignoriert worden seien. Das ist nicht geschehen. Insbesondere hat die Fahrt von Wilkes an der Nordküste von Ost-Antarktika immer volle Anerkennung gefunden, ist doch der Name Wilkes Land jenem Küstenstriche gegeben worden. Aber Zweifel sind entstanden, da sich nicht alle Angaben von Wilkes als stichhaltig erwiesen haben. Dies gilt insbesondere von den Angaben von Land auf einer Karte, welche Wilkes James Ross gegeben hat. Bereits letzterer passierte am 6. Januar 1841 eine solche Stelle und fand hier tiefes Wasser, und seither hat Scott auf seiner Heimreise genau den Ort auf offener See passiert, wo Wilkes angibt, am 19 Januar 1840 3000' hohes Landgesehen zu haben. Endlich hat E. v. Drygalski bekanntlich Termination Land nicht an der Stelle gefunden, wo es Wilkes es gesichtet haben will.

In this short paragraph the reviewer makes five statements which call for an answer.

1 and 2. The reviewer says it "has not happened" that the work of American explorers was ignored in England: and also that Wilkes has had full recognition.

In order to recognize the erroneous nature of these two statements it is only necessary to turn to many of the papers of Sir Clements R. Markham, beginning with his article "Polar Regions"[3] and culminating in his article "The Antarctic Expeditions,"[4] in which he mentioned many of the more prominent Antarctic explorers, but ignored totally Wilkes's discovery of the mainland of East Antarctica and Palmer's discovery of the mainland of West Antarctica. Scott's various misstatements about Wilkes,[5] winding up in his silly assertion "thus once and for all we have definitely disposed of Wilkes Land," can also be cited as attempts at disparagement.

[3] "Encylopædia Britannica," ninth edition, American reprint, 1885.

[4] *The Geographical Journal*, 1899, Vol. XIV., pp. 473–481.

[5] "The Voyage of the Discovery," *passim*.

Of course, some English writers are just and fair, and a shining example is Dr. Hugh Robert Mill, who writes in accord with the evidence[6] and whose excellent work the reviewer might consult with profit.

3. The reviewer repeats the old misstatement about Ross sailing over a part of Wilkes Land. I supposed that I had killed that piece of fiction[7] and that Dr. Mill had laid its ghost.[8] This matter would take too much space for rediscussion here, and it seems sufficient to mention the fact that, as far as I am aware, my italicized statement "none of Wilkes's discoveries were disproved by Ross, for the simple reason that Ross never was within sighting distance of any part of Wilkes Land"[9] has never been challenged.

4. The reviewer says that Scott passed "exactly the spot on open sea," where Wilkes states he saw land. Now Scott makes no claim to sailing over any part of Wilkes Land. On his return voyage, Scott sailed westward towards Cape Hudson, but when he got within about fifteen miles of where Wilkes had charted it—doubtless fifty miles too far north—Scott turned northward and sailed away. A glance at Scott's chart[10] proves this absolutely and that Scott therefore did not disprove any of Wilkes's discoveries.[11]

5. The reviewer says that Drygalski did not find Termination Land at the place where Wilkes said he had seen it. Now Wilkes, at the most westerly point of his memorable cruise along the northern coast of East Antarctica, saw appearances of land to the southwest and charted them as Termination Land. Then Drygalski on his cruise south discovered to the eastward a "high ice-covered land." And a comparison of the charts of the two explorers proves that Drygalski's "high

[6] "The Siege of the South Pole," 1905.

[7] "Antarctica," 1902.

[8] "The Siege of the South Pole," pp. 246–247, 287.

[9] "Antarctica," p. 183.

[10] "The Voyage of the *Discovery*."

[11] See "Wilkes Land," *The Bulletin of the American Geographical Society*, January, 1906.

ice-covered land" must be the western edge of Termination Land.

I explained this matter fully in an article "Termination Land."[12] That article was commented on in Germany at length by Dr. Singer,[13] who concluded that there was no reason for leaving the name "Termination Land" off the charts, and who also published with his article an excellent map proving that Termination Land and Drygalski's high land are one. It was also commented on by Dr. H. Wichmann[14] who stated likewise that there was no cause for taking the name Termination Land off the charts; and by Dr. H. Haack,[15] who wrote that Drygalski's assumption could not be kept upright. That is to say, three leading German geographical authorities entirely agree with me as to Drygalski's high ice-covered land being Termination Land.

EDWIN SWIFT BALCH

SCIENTIFIC BOOKS

Putnam Anniversary Volume. Anthropological Essays presented to Frederic Ward Putnam in Honor of his Seventieth Birthday, April 16, 1909, by his Friends and Associates. New York, G. E. Stechert & Co. 1909.

The pupils, colleagues and friends of Professor Frederic Ward Putnam have chosen the very happy and suitable method of celebrating his seventieth birthday by presenting him with a volume of original anthropological essays. I had the pleasure of first meeting Professor Putnam at the Toronto meeting of the British Association in 1897 and was at once charmed by his personality. Since then I have renewed my friendship with him on every possible occasion, and have been more and more impressed with his enthusiasm and knowledge. I have seen the results of his labors in Cambridge, New York and Berkeley and have learned from his pupils how much they are indebted to him for their training, guidance and wise counsel. But in addition to gratitude for these advantages they feel a personal affection for the man himself, which is shared also by his colleagues at home, in England and elsewhere. It is as an honored and beloved master that his former pupils and friends offer this tribute.

It is manifestly impossible to give an account of the twenty-five essays, but the following statement will give some idea of their scope. A bibliography of over four hundred items indicates Professor Putnam's activity, but many of these are notes and annual reports. It is interesting to find that Professor Putnam, like so many anthropologists, started his scientific life as a zoologist; for ten years he was curator of ornithology in the Essex Institute and later took charge of the Vertebrata. Though most of his zoological papers deal with vertebrates, he also published a few papers on invertebrates. In 1869 he published the first annual report of the Peabody Academy of Science, and his last purely zoological paper was published in 1879.

By far the greater part of Professor Putnam's anthropological work was in the domain of archeology, so it is fitting that the first essay should be on "The Archeology of California," by an old pupil, A. L. Kroeber; thirty years previously Professor Putnam had written on the subject, and it is well known that the anthropological school of the University of California owes much to his wise direction. This essay gives a bird's-eye-view of what has since been accomplished, and enables us to form some estimate of the civilization of the ancient inhabitants of California. Among the archeological papers is a beautifully illustrated memoir on "Ancient Zuñi Pottery," by J. Walter Fewkes, which gives a needed synopsis of the old types of decorated vessels of the Zuñi, and the conclusion is drawn that the radical difference in the symbolism of prehistoric and modern Zuñi pottery confirms legendary evidence of the dual composition of the tribe. Charles C. Willoughby describes

[12] *The National Geographic Magazine*, Vol. XV., May, 1904, p. 221.

[13] *Globus*, Vol. 86, No. 4, p. 63.

[14] *Petermann's Geographischen Mitteilungen*, 1904, Heft VII., p. 2.

[15] *Geographischer Anzeiger*, 1904, IX., p. 201.

in an illustrated article the "Pottery of the New England Indians"; this falls into three groups, Archaic Algonquian, Later Algonquian and Iroquoian. "The Slip Mound," which is described by William C. Mills, belonged to the highest culture of pre-Columbian man in Ohio; the builders of the mound had an intertribal trade, as evidenced by the copper from the Lake Superior region, the ocean shells and alligator teeth from the far south, and mica from North Carolina. Mr. Warren K. Moorehead in his "Study of Primitive Culture in Ohio" establishes Professor Putnam's classification of the remains into the Fort Ancient and Hopewell cultures and adds an earlier one of the "Glacial Kames." The Hopewell culture, to which the Seip Mound belongs, migrated from the south, and the original contention of Professor Putnam that the southern people had short heads and the Fort Ancient people had long heads has been proved. Marshall H. Saville gives a beautifully illustrated paper on the cruciform structures of Mitla and its vicinity; the form of the cross was connected with the cult of Quetzalcoatl and is proof of the widespread range of the Nahuan pantheon, for we find his worship throughout the area of the Mayan culture, as well as in different parts of Mexico. George B. Gordon deals with the treatment of the macaw in Mayan art at Copan, and C. W. Mead with the fish in ancient Peruvian art. Mrs. Zelia Nuttall shows that the art of dyeing cloth by means of the *Purpura patula* has been continued in Mexico from pre-Columbian times to the present day, and points out that in the old and new world alike these are found in the same close association: (1) the purple industry and skill in weaving; (2) the use of pearls and conch-shell trumpets; (3) the mining, working and trafficing in copper, silver and gold; (4) the tetrarchial form of government; (5) the conception of "four elements"; (6) the cyclical form of calendar. The tribal structure of the Omaha is lucidly described by Miss Alice C. Fletcher, and in a well-illustrated memoir A. M. Tozzer describes several religious ceremonials of the Navaho, who borrowed, to be sure, but they were by no means simply borrowers: they adapted and developed and, in many cases, especially in regard to the sand pictures, they did everything but actually invent the idea. Papers on linguistics are given by F. Boas (Iroquois), Roland B. Dixon (Wintun) and John R. Swanton (Siouan). S. A. Barrett describes the elaborate numerical system of the Cayapa of Ecuador and Charles P. Bowditch discusses some dates and numbers of the Dresden Codex. It is characteristic of the trend of American anthropology that there is only one paper on physical anthropology, that of Aleš Hrdlička, on the stature of the Indians of the southwest and of northern Mexico. There are a few papers which deal with non-American subjects, such as: Charles Peabody's essay on certain quests and doles, which is a very interesting study on a neglected branch of European folk-lore, and F. N. Robinson's notes on the Irish practise of fasting as a means of distraint, it being regarded as a procedure which it was in some way dangerous to resist. G. L. Kittredge in a learned essay brings evidence of a tradition of very long standing which asserts that Hercules set up pillars at both ends of the world, that is at the eastern end as well as the western. Professor Putnam, as some of his students have assured me, is a stimulating teacher, which, however, could be readily inferred from the mark his pupils have made in our science, and doubtless he has thoroughly appreciated the development of his ideas in very excellent scheme of instruction in primitive industries suitable for a normal college course by Harlan I. Smith.

This brief notice of an important collection of essays may fittingly conclude with an endorsement of the final paragraph of the dedication of the volume to Professor Putnam by Professor Boas:

> May many years of health and strength be granted you to see the ripening of your plans and the achievements of your younger friends, whose progress has always been a chief pleasure to your life!

Alfred C. Haddon
Blue Hill Meteorological Observatory,
December 7, 1910

Municipal Chemistry. A series of thirty lectures by experts on the applications of the principles of chemistry to the city, delivered at the College of the City of New York, 1910. Edited by CHARLES BASKERVILLE, Ph.D., F.C.S. New York, McGraw-Hill Book Company. 1911. Pp. 526. $5.00 net.

The title of this book is sufficiently suggestive of its intended scope. The lectures here brought together in printed form were given before the student body of the College of the City of New York in the spring of 1910 and were open to the public. The interest they aroused was taken as sufficient to warrant the publication for a larger audience.

Chemistry plays a very important and ever-widening part in the affairs of life, and especially of the life as it is lived in a great city. Problems of food supply and preservation, of pure water and disposal of sewage, of garbage cremation and smoke prevention, and a dozen more which might be easily mentioned, call for the aid of the chemist in some direction. It is proper to present to young people in college the conception of the chemist as a man who can do things which the city needs, and on a broad scale. The chemical problems of the city are not merely those of routine analysis, although many analyses may be necessary in their solution.

The men selected by Professor Baskerville to deliver the course of lectures are, for the greater part, well known authorities in their several specialties, and while some of the topics discussed bear but a remote relation to questions of municipal chemistry, in the narrower sense, it must be admitted that they are all of interest at the present time. The editor contributes a good introductory lecture. The papers by Professor Mason on the relations of drinking water to disease and on the purification of water; by Mr. Flinn, of the New York Board of Water Supply, on the water problem in that city and the work in the Catskill Mountains; and by Professor Winslow on the disposal of sewage are perhaps the most interesting in the book. The discussion of the city milk supply problem by Dr. Darlington is also timely and quite worth reading.

In addition to these topics there are lectures on food and drug adulteration, on illuminating gas, smoke prevention, ventilation, explosives, paints, corrosion of metals, cements, road building, textiles, parks and playgrounds. It will be seen that a wide range of topics is covered, and in general in a way to interest young people. The whole presentation is naturally elementary and not of a character to appeal to specialists. In fact, the moderately informed man will recognize most of the discussions as old friends with which he is already familiar. But the book is not intended for the well informed but for those who need and are seeking general practical information. From this point of view it merits a cordial reception.

J. H. LONG

SPECIAL ARTICLES

EXPERIENCES WITH THE GRADING SYSTEM OF THE UNIVERSITY OF MISSOURI[1]

WHY should there be uniformity of grading in an educational institution? somebody might ask. If different grades were simply means of giving some students notoriety above others, the question would be immaterial, for a gentleman does not seek notoriety. But the grade has in more than one sense a cash value, and if there is no uniformity of grading in an institution, this means directly that values are stolen from some and undeservedly presented to others.

The result is that, among the members of the faculty as well as among the students, men look at each other with suspicion. That this attitude is detrimental to the feeling of unity, to the development of a college spirit, is clear to even the most superficial observer. Whatever contributes to a greater uniformity of grading, contributes directly towards more peace, a better mutual understanding, a greater community of purpose among all the members of the institution.

Whoever admits the fact just stated will find much encouragement in the present

[1] Read before Section L of the American Association for the Advancement of Science at the Minneapolis meeting.

status of grading in the University of Missouri, compared with that of three years ago. At that time the university had the traditional marking system based on percentages of an ideal maximum accomplishment, called "100." There would be no objection to this system if all the grading in the institution were done by a single instructor. Experience teaches that different instructors even in the same subject have very different conceptions of what this ideal maximum accomplishment "100" really is.

Among teachers of different subjects this difference of conceiving the maximum accomplishment becomes enormous. There can be then no uniformity of grading, and all the evils resulting from this condition find an open door. Three years ago the diversity of grading had reached such a degree that the faculty took a radical step, abolished the antiquated system and introduced the grading by rank. This does not mean that the teacher is in any way interfered with if he uses, for his private purposes, the marking by percentages of his ideal maximum accomplishment. But the institution no longer accepts such percentages for its official records. Instead the institution requires each teacher to report for each student his estimated rank among a hundred students. This method is a little complex on account of the hundred different grades. To simplify it the grades are united into groups by division lines, which, however, are not at all drawn by each teacher according to his own opinion, but fixed by authority of the faculty of the university. The teacher now divides his list of a hundred students (whom, according to rank, he has graded himself, of course, since no one else can do this) into four groups of twenty-five students each, or, if the teacher prefers, an executive officer of the institution can divide them into these groups.

The students of the first group are marked E or S. Either of these "grades," therefore, does not stand for any degree of accomplishment as defined by anybody, but stands for the numbers from 1 to 25. The faculty has not yet drawn the division line between those of the twenty-five to be marked E and those to be marked S. But the actual practise of two sessions has been to mark the first four E and the following twenty-one S. The following two quarters of the list are marked M. This is prescribed by the rule of the faculty and leaves the teacher no choice. The last twenty-five are again divided into two groups called I and F.

The faculty has again left it, at present, to the discretion of the teacher to draw this division line. But actual practise has shown itself in favor of separating the last seven of these twenty-five as failures, and marking the eighteen students remaining above these seven as I.

Of course, a teacher does not, as a rule, have classes of just a hundred students. But he can distribute the five grades in the same way whatever the actual number of his students. Only in small classes there is this difficulty left that in any semester the membership may be unusually good or unusually bad. The teacher, therefore, is not expected at all to comply with the rule until, possibly after several semesters or even years, he has reported to the official recorder of grades several hundred grades. Then, sooner or later in the case of different individuals, the faculty calls him to account for what he has done. In Missouri the faculty has a special committee charged with this general supervision of the grading.

The system has now been in use for over two years. Considering all the grades reported during these four semesters and three summer sessions, we find that the highest four per cent. are excellent (E), the following twenty-one are superior (S), the following fifty-two are medium (M), the next sixteen are inferior (I) and the last seven have failed (F), not taking into account decimals. The only deviation from the rule, then, consists in this that two of the eighteen students of the I class have been marked one step too high, as M. Such an amount of regularity in general was perhaps to be expected. More interesting is the variation of marking found among the individual teachers.

In order to compare the individual teachers,

let us represent graphically the marking by them of those students who according to the rule ought to be marked M and who are just one half of the total number, having twenty-five per cent. above them and twenty-five below. Each of the seventy-two rectangles of the diagram of Fig. 1 represents by its horizontal extent these students. If every teacher

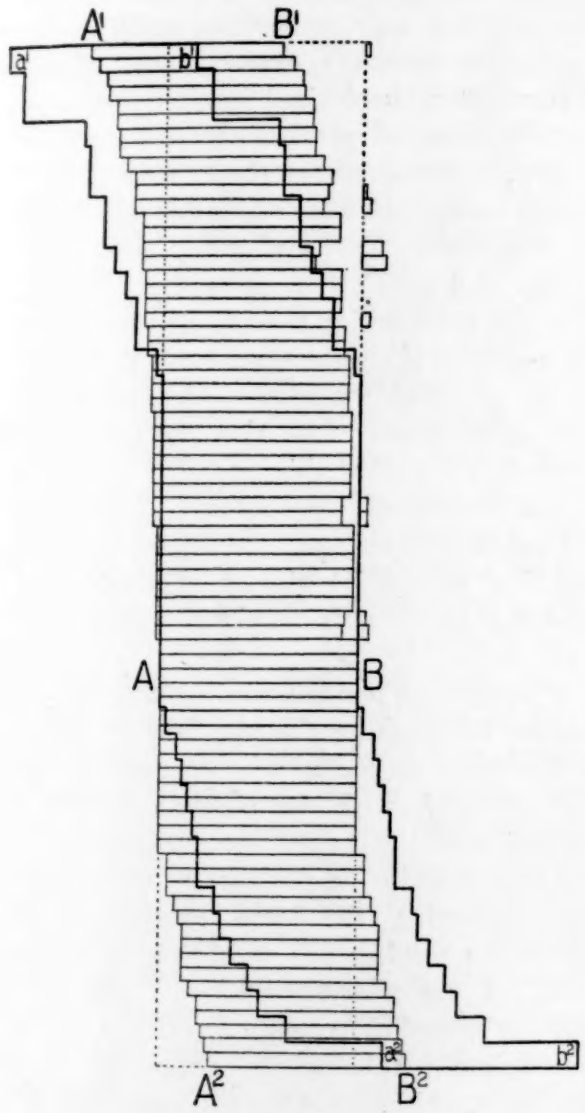


FIG. 1

had actually given all of these students the grade of M, these rectangles would lie exactly one over the other, forming the straight column indicated by the dotted lines. The greater the fraction of these M-students who have received from their teacher S instead of M, the more the particular rectangle reaches beyond the left border of the column. The most extreme case of this high grading is found above at A^1, B^1. Below where the rectangles reach beyond the right border of the column, we find those teachers represented who have given a fraction of their M-students the grade of I. The lack of uniformity may be measured by the ratio of the total area lying outside the column to that of the column itself. This ratio is about ten to a hundred, so that we may say that one tenth of the grades given are unjust in being either one grade too high or one grade too low.

The diagram which has just been explained represents the grading from the time of the introduction of the new system to the end of the first semester of the last session, that is, the grading of three semesters and two summer sessions. The last semester is not included because of a change made in the method of compiling the statistics. The diagram, further, represents only seventy-two teachers. Those who did not report, during the time mentioned, at least ninety grades, have been omitted. It would be unfair to include teachers who had so few students because in the case of these teachers the variations must be regarded as accidental. That the deviation from the standard amounts nevertheless to one tenth illustrates the great resistance with which the introduction of a new system of grading, the requirement of a new way of thinking, meets in a mind influenced by traditions of a different past. There seem to be still not a few teachers who report their E's, S's, etc., as if these grades represented well-defined or definable percentages of a maximum ideal accomplishment of "100" instead of rank. There seem to be others who only with difficulty get accustomed to the idea that we have now four passing grades, whereas formerly we had only three, and who on this account hesitate to assign the fourth grade, the I. However, that these deficiencies in the actual working of the system will speedily disappear seems to follow from the great progress already made, which becomes obvious when we compare the lack of uniformity under the present system of grading with that prevailing under the previous system.

In the same diagram the black lines represent in the same manner the grading by forty teachers of rather large numbers of B-students during five sessions of the university. The former passing grades were A, B and C, and these were assigned, on the average, to 24 per cent., 35 per cent. and 32 per cent. of the students. Since the B-group is the largest of these, it is best to use it for comparison with our present M-group. The diagram shows what fractions of the B-students were given the grade of A (at the top) or a grade lower than B (at the bottom of the diagram). The scale of drawing, for comparison's sake, has been adjusted so that the central column of this case is identical with the central column for the M-students of the present system. The diagram clearly shows that a large fraction of the B-students were formerly unjustly marked other than B, in figures, 24 per cent. of them. And worse than this, many students were graded two steps lower by one teacher than by another. For example, take a student in the center of a file of B-students. Under one teacher, at a^1, b^1, in the diagram, such a student standing just in the middle between a^1 and b^1 would invariably receive the grade of A. Under another teacher, a student of the same rank of scholarship, standing in the middle between a^2 and b^2, could not entertain the slightest hope of getting a higher grade than C. Moreover, the best of the B-students, at the point of a^2 in the diagram, would get no B under this teacher. Such enormities of divergence have forever disappeared since the introduction of the new system. Even the extreme cases of the M-students, A^1, B^1 and A^2, B^2, overlap to some extent. The ratio expressing the lack of uniformity in grading was twenty-four to a hundred as short a time as two years ago. It is now ten to a hundred. I am confident that it will still further decrease in the near future. The improvement already attained is really greater than it appears in the diagram, although it is there conspicuous enough. The teachers who varied so enormously under the old system were all teachers of very large classes, so that there was no possible excuse for this variation. I must point this out also for another reason. Professor Dearborn, in discussing our former variations, thought that they were probably to be explained by the fact that teachers of small and advanced classes had been included in the statistics. They were not.

I am sure that any institution can in the same way make its grading more and more uniform, but only under the condition that the faculty does not expect mere legislation to accomplish the desired result. Our experiences in Missouri prove conclusively that it is absolutely necessary for the faculty to have a special committee which collects each semester the cumulative results of the grading of each teacher and calls attention to those deviations from the rules which seem to be unwarranted. We publish each semester among the teachers of the university a statistical table showing how each teacher has thus far graded his students. I regard this publicity as essential to the success of our system. Besides this, our committee collects data as to the relative standing of special classes of students, for example, athletes, fraternities, women, freshmen, etc.

Although the method used by the individual teacher for ranking the members of his class is irrelevant to the system of grading under discussion, I wish to mention briefly the method used by myself because there is no end of complaint on the part of college teachers concerning the large amount of time which the teacher has to spend on examinations. I use almost exclusively the conjectural or completion method which was introduced into psychological science by the late Professor Ebbinghaus for the measurement of general intelligence, but can be used with equal success for the measurement of the student's rank in a class. The following is an example of an examination blank in which certain words have been omitted. The student must fill in the blank spaces in such a manner that the whole becomes meaningful.

The fact of *simultaneous* color induction is well illustrated by the *Hering* window. This consists of two narrow windows at some distance from

each other. Any object then throws two shadows, one from each window. The one shadow coming from the colorless window ought to be simply *dark*, but appears, if the other window contains, say, red glass, of a saturated *red* color because at this shaded spot no *white* light is mixed with the *red* light. Everywhere else this mixed illumination takes place and makes the observer overlook the fact that the whole room with everything in it appears actually *reddish*. The other shadow, coming from the red window, might be expected to appear simply *white*, since this shaded spot is illuminated only by *white* light. As a matter of fact, it appears, by *induction*, *green* because the whole room excepting this spot stimulates on our retina the *red* process. The area on the retina corresponding to this shaded spot is therefore the only one where the disturbed *equilibrium* of the components of the *red-green* substance can be to some extent *restored* by spontaneous action of the sense organ. (Words in italics are blanks.)

The maximum number of points which any student could make in the quiz shown is fifteen. In case the word inserted was not quite correct, but indicative of the right approach to the solution of the problem, one half point was given. A class of twenty-six students made the number of points shown in the table below. Students having the same number of points were given precedence according to the order in which they had been able to hand over their quizzes to the instructor. Ranking these papers took about thirty minutes, and having completed the task the instructor felt sure that he had done no appreciable injustice to any of the students. Ranking twenty-six different essays on the same subject, the Hering window, would have taken several hours, and the instructor would have finished his task with the unpleasant conviction that his ranking in many cases was arbitrary.

	Points		Points		Points
1	15	10	12½	19	5½
2	15	11	12½	20	5½
3	14½	12	12	21	5½
4	14½	13	11½	22	5½
5	14	14	10	23	5
6	13½	15	8½	24	4½
7	13	16	7	25	4½
8	13	17	6	26	2½
9	12½	18	6		

I do not record the number of points made in any quiz by any student, but only his rank, placing those who "cut" at the bottom of the class. I find that this is an excellent way of insuring class attendance. At the end of the semester I sum up the rank numbers of each student and, by the smallness of the total, determine the rank for the whole semester. By recording in each quiz, not the points made, but only the rank, we overcome the difficulties in grading caused by the fact that examinations are sometimes too easy, sometimes too hard. In either case the best students come out on top, the poor students at the bottom, especially when we take into account, as mentioned above, the time within which each student completed his task.

Let us take up another problem, which, it seems to me, is dependent on our system of grading, but which is by no means a part of this or any system of grading. I believe that Professor Cattell was the first to point out the justice of giving more credit towards graduation to those students who ranked high in scholarship than to those who ranked low. Now, the first and absolute condition of giving varying credit is a method of controlling the uniformity of grading in the institution. Without this the injustice done by diversity of grading on the part of different instructors is only multiplied. In the University of Missouri we credit an E with 30 per cent. plus, an S with 15 per cent. plus, an M with the normal credit, an I with 20 per cent. minus and an F with nothing. It must be understood that the choice of these quantities is for the most part experimental. We are gathering data to put our credits on a more strictly scientific basis.

I have heard of only one real argument questioning the justice of varying credit. Some believe that by letting a student of excellent scholarship graduate after having taken a somewhat smaller variety of courses than the average student, we give the degree to one who does not have the breadth of training which a college graduate ought to

possess. I must say that, judging from my own experience with students, this argument is a fallacious one. I have never had an excellent student in psychology who did not have a good knowledge in languages, in history, in biology, etc. Indeed, I am inclined to assert that his knowledge of these other sciences, his comprehension of the relation existing between psychology and these other sciences, made him an excellent student in psychology. And this, I think, holds good also for other studies, more or less. I therefore believe in varying credit. We ought not to make conditions in college unnecessarily different from conditions in life. In life too our credits vary.

The amount of credit which we give for different scholarly accomplishments depends on our view as to what is the distribution of such accomplishments in a large number of students. The division lines which we draw between the different grades, as explained above, also depend on our assumption of a definite curve of distribution. I am inclined to think that, owing to the insufficient data which we possess at present, we have to base our conclusions on the normal curve. Three years ago I had the honor of speaking on this very question before this section of the American Association. I then criticized certain conclusions drawn by Professor Hall. Since my criticism has been slightly misunderstood, I wish to repeat what I wanted to point out. I did not want to belittle Professor Hall's work on the distribution of scholarly abilities. But I held, and still hold, that Professor Hall found his students distributed in accordance with the normal curve simply because he believed, while he was teaching and examining these students, that they ought to be distributed thus. I shall try to make this clearer.

Fig. 2 shows two entirely different curves of distribution. You may be surprised that these are the same students in the same subject. The only difference is that the broken lines represent the outcome of a very difficult examination, requiring a large amount of reasoning; the continuous lines represent the outcome of an examination of the kind most commonly given by instructors, which enables most of the students to respond to a majority of the points correctly, especially when there

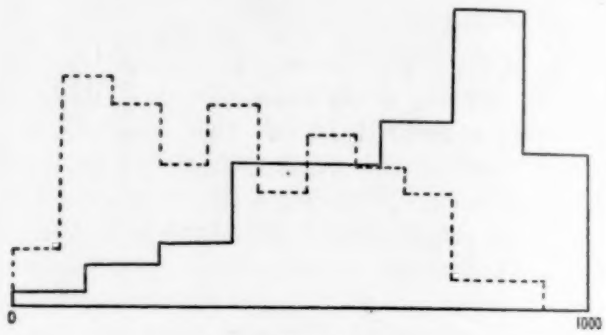


Fig. 2

is no time limit, or when the time of completing the task—of such enormous significance in life—is not taken into account at all. College teachers usually assert that the curve of distribution is not the normal curve, but a skewed curve like that of the continuous lines. They are usually ready to explain this by referring to the elimination of poor scholars in the high schools and lower schools. I have considerable doubts as to this elimination. Is the work done in a high school really so much like that done in college that there is a large previous elimination of poor college students? Our curves clearly show that the skewed distribution which an instructor finds is likely to be simply the result of the kind of examination which he gives. If he believes that the distribution ought to be like the curve of the continuous lines, he will give his examinations accordingly. If he believes otherwise, he will give his examinations otherwise.

I do not admit, then, that anybody has proved thus far that the distribution of scholarly accomplishments in college is like the normal curve or like a curve skewed either way. Under these circumstances, if for any purpose we have to assume, at least provisionally, a particular distribution, I see no other possibility than that of regarding scholarly accomplishments as based on biological properties and assuming the normal curve as the most probable one.

All this, however, does in no way interfere with our actual practise of grading. Our division lines between the different grades may be drawn somewhat arbitrarily, the relative credit given for the different grades may be somewhat arbitrary, the injustice done the students under a system which enforces uniformity of grading is nevertheless small compared with the injustice when each instructor is left to grade according to his own fancy.

MAX MEYER

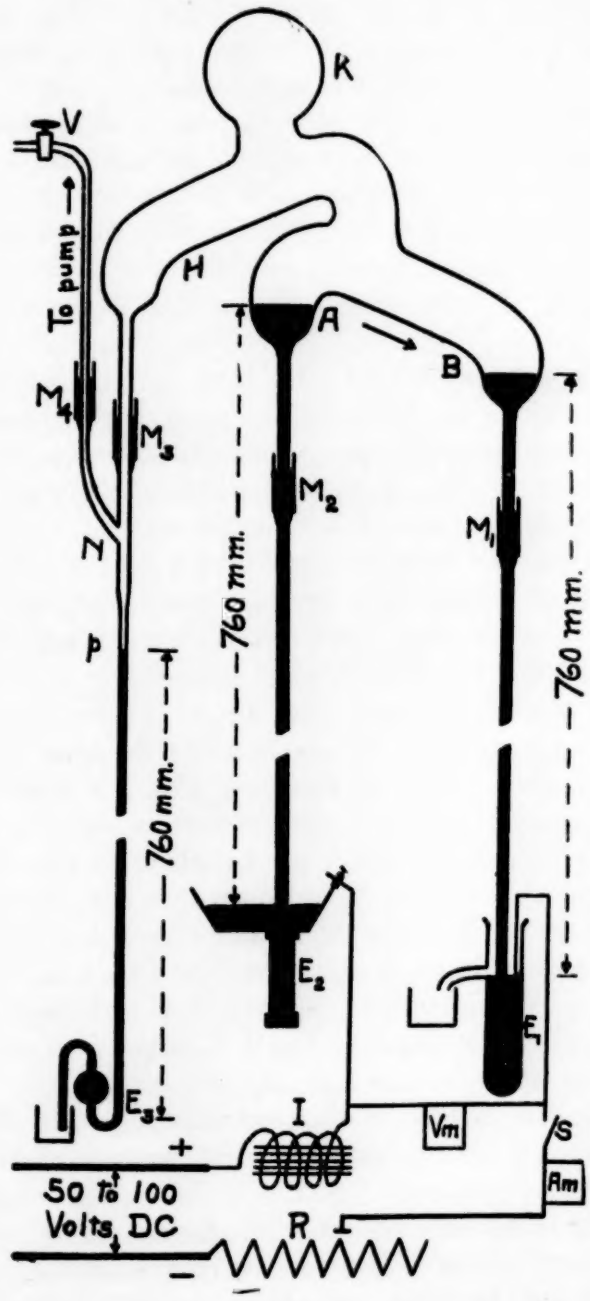
UNIVERSITY OF MISSOURI

AN EFFICIENT AND RAPID MERCURY STILL

IT is with some hesitancy that the writer attempts a description of so simple and commonplace an apparatus as a mercury still. Nearly every laboratory has its own method of purifying mercury. However, of the various "dry" methods that are usually employed two stand out prominently—Weinhold's method and Hulett's method.[1] The principle of the first is to distil under reduced pressure or partial vacuum; while the second in addition to this makes use of a small jet of air bubbling up through the mass of mercury. The jet of air plays the rôle of oxidizing the metallic impurities. Both methods are good. The purifying effect of air bubbling through mercury, even at room temperature, is now well recognized.

In 1905 the writer described a new form of still,[2] in a brief paper read before the American Association for the Advancement of Science, at its New Orleans meeting, in which use was made of the mercury vapor lamp. A description of the apparatus[3] as at present modified and perfected by several years' use in the laboratory is the object of this paper.

It is common observation that mercury condenses on the walls at the cooler parts of the lamp. Now by fusing to the mercury vapor lamp a properly shaped condensing chamber, mercury of a high degree of purity may be obtained. For the apparatus to be a practical working still the lamp must have additional modifications. Fig. 1 shows all of the essential parts. The mercury arc is maintained between the electrodes A and B. These electrodes are of mercury and are in communication, through the narrow barometric legs BE_1 and AE_2, with the vessels E_1 and E_2 containing the supply mercury. These vessels are connected directly through an adjustable resistance and an inductance to some convenient source of direct current. It is well to include



[1] Hulett, *Phys. Rev.*, Vol. XXI., December, 1905.

[2] SCIENCE, Vol. XXIII., March 16, 1906.

[3] Letters Patent, U. S. A., Nos. 891,264, 891,265; Germany, No. 201,017.

in the circuit an ammeter, a voltmeter and a switch as shown in the figure.

The condensing chamber HK may have a variety of forms—the one sketched possibly serves the purpose best. It will be noticed that the condensed mercury is, by the inclination of the tube H, diverted and leaves the still through a capillary delivery tube M_3E_3 bent into the form of an S at its lower end. The action of the mercury dropping into this tube is that of a continuous mercury pump. The nipple N for initially exhausting the system is fused, for convenience, to the upper end of this delivery tube. M_1, M_2, M_3, M_4 are mercury seals.

The operation of the still is very simple and when once under way needs but little attention. Fill the vessels E_1 and E_2 with the mercury to be distilled and allow the mouth of the delivery tube to dip into a small beaker of clean mercury. Now start the exhaust pump (an efficient mechanical pump will answer) and adjust the position of the vessels E_1 and E_2 until the electrodes A and B rise to the heights indicated in the figure. The mercury in the delivery tube should now stand at some point p 5 or 6 cm. below the nipple N. To start the arc it is only necessary to lift the vessel E_2 slightly and allow a momentary stream of mercury to flow down the tube AB. If the vacuum is right the arc should start instantly. Adjust the current to the proper value. After fifteen or twenty minutes the valve V may be closed, provided the various mercury seals do not leak. The supply mercury is drawn mostly from the vessel E_2 and it therefore should be of large surface and rather shallow. The vessel E_1 is provided with an overflow.

The rate of distillation depends upon the size of the apparatus and the strength of current employed. In the stills as first constructed the diameter of the tube AB was about 20 mm. This gave for a current of 4 amperes approximately one pound per hour. The corresponding fall of potential across the terminals was 21 volts. Later the diameter of AB was increased to 40 mm. and its length to 25 cm. The size of the condensing chamber HK was proportionately larger. This still gave for a current of 10 amperes approximately 2 pounds per hour. The potential difference across the terminals was 23 volts.

To test the purity of the distillate zinc amalgams were used. The test for zinc was made by the electromotive-force method described by Hulett. One millimeter deflection of the galvanometer corresponded to approximately .0005 volt. The results are given in the following table:

No.	Zinc Amalgam	Distillate from Zinc Amalgam	Deflection of Galvanometer
2*a*	1:700,000	—	2.17 mm.
100	1:370,000	—	4.00 "
a		1:1740	.61 "
b		1:1740	—.19 "
c		1:1740	.55 "

From numbers 2*a* and 100 we see that a deflection of 1 mm. corresponded to the presence of zinc in the ratio of 1:1,500,000. Samples *a*, *b*, *c* were from an amalgam that was, comparatively speaking, very impure to zinc, yet the distillates condensed in three separate condensing chambers showed practically no trace of zinc. The standard against which the above was balanced in the test cell was newly purchased commercial double distilled mercury and was in addition carefully and repeatedly purified by the "wet" method. Numerous additional tests under various conditions have been made and all show that the still is capable of giving a distillate of the highest purity. In fact, very pure mercury may be obtained by a single distillation even though the original is very impure. As an example may be given a test in which the original mercury was excessively impure to zinc. After distilling off six or eight pounds the current was broken and the apparatus let stand over night. In the morning the anode was completely covered with a layer of zinc an eighth of an inch thick that had crystallized out on cooling. The distillate showed scarcely a trace of zinc. In this instance the arc was maintained by a small current density and consequently the average temperature[4] in the

[4] Knipp, *Phys. Rev.*, Vol. XXXI., August, 1910.

arc was very much below the melting point of zinc.

The residue remains within the still. This should be digested out from time to time, depending upon the condition of the impure mercury. Where one is dealing with comparatively pure mercury 50 to 75 pounds may be distilled off during a single run.

CHAS. T. KNIPP

LABORATORY OF PHYSICS,
UNIVERSITY OF ILLINOIS,
January, 1911

THE ASSOCIATION OF AMERICAN GEOGRAPHERS

THE seventh annual meeting was held at Pittsburgh, December 29–31, 1910, under the presidency of Dr. H. C. Cowles, of the University of Chicago. His address was upon the subject, "The Causes of Vegetative Cycles." Public lectures were given by Professor Mark Jefferson on "Rocky Mountain Forms," and by Dr. Cowles on the "Origin and Destiny of the Everglades." Professor Rollin D. Salisbury conducted a round table conference on the "Purposes of Geographic Instruction, and the Phases of the Subject best adapted to these Purposes." About twenty-five papers were read by the members.

The following officers were elected: *President* Professor Ralph S. Tarr, Cornell University; *First Vice-president,* Alfred H. Brooks, U. S. Geological Survey; *Second Vice-president,* Henry G. Bryant, president of the Geographical Society of Philadelphia; *Secretary,* A. P. Brigham, Colgate University; *Treasurer,* Professor N. M. Fenneman, University of Cincinnati; *Councillor* (for three years), Professor Herbert E. Gregory, Yale University.

The following were appointed as delegates to the Geographical Congress to be held in Rome in October, 1911: Cyrus C. Adams, A. P. Brigham, H. C. Cowles, W. M. Davis, H. W. Fairbanks and Ralph S. Tarr.

Members newly elected are: Charles A. Davis, U. S. Bureau of Mines; F. V. Emerson, University of Missouri; Otto E. Jennings, Carnegie Museum, Pittsburgh; Wolfgang L. G. Joerg, American Geographical Society; Alexander G. Ruthven, University of Michigan; Victor E. Shelford, University of Chicago; L. H. Wood, Western State Normal School, Michigan.

The association has voted to establish a publication, and has appointed the following publication committee: Richard E. Dodge, chairman and editor, Alfred H. Brooks, Henry C. Cowles and Ralph S. Tarr.

Following the discussions of the round-table conference, the association adopted the resolutions herewith appended.

"The Association of American Geographers at its Pittsburgh meeting, December 29–31, discussed the present status of physical geography in secondary education and passed the following resolutions:

"*Resolved,* that in the opinion of this association physical geography fully deserves to retain a place in the high school.

"That the disappointment or dissatisfaction sometimes expressed regarding the results of teaching this subject is in large measure due to inefficient teaching.

"That as a means of removing this dissatisfaction, superintendents and principals are urged to procure teachers of physical geography adequately prepared in their subject, and to entrust the subject only to such teachers.

"That no teacher of physical geography should be appointed in any educational grade who has not made serious and special study of the subject in a higher educational grade."

A committee on state educational bulletins was appointed to report at the next meeting: N. M. Fenneman, chairman, W. M. Davis and R. H. Whitbeck.

The next meeting will be held in Washington in connection with the American Association for the Advancement of Science.

ALBERT PERRY BRIGHAM,
Secretary

SOCIETIES AND ACADEMIES

THE FOURTH ANNUAL MEETING OF THE ILLINOIS STATE ACADEMY OF SCIENCE

THE fourth annual meeting of the Illinois State Academy of Science was held Friday and Saturday, February 17 and 18, at the University of Chicago.

About two hundred persons attended the combined sessions of the two days, and the excellence of the papers and the general air of enthusiasm which prevailed was on a par, if not in excess, of previous meetings. The total membership is now four hundred and eight; of this number, thirty-seven were elected at the Chicago meeting. A study of the geographic distribution of the membership is significant, as the annexed table shows.

Chicago	118
Urbana	114
Springfield	30
Evanston	12
Decatur	10
Scattered	122

The above condition is a very gratifying result of the four years of the academy's efforts, but it is fully realized that it falls far short of the ideal toward which the state academy is aiming. There is no apparent reason why the Illinois State Academy of Science should not, in a few years, have an enrolment of a thousand members and wield an influence for good which will be felt not only by the educational institutions and the citizens of our great commonwealth, but also by our sister states whose state academies preceded ours by several decades.

The following officers were elected for the ensuing year:

President—W. A. Noyes, Illinois State University, Urbana, Ills.

Vice-president—J. C. Udden, Augustana College, Rock Island, Ills.

Secretary—Frank C. Baker, The Chicago Academy of Sciences, Chicago.

Treasurer—J. C. Hessler, James Millikin University, Decatur, Ills.

The following committees were appointed or continued:

Membership Committee—H. C. Cowles, Chicago; Marion Weller, De Kalb; E. N. Transeau, Charleston; C. C. Adams, Urbana; J. W. Read, Jacksonville.

Committee to Investigate the Status of High Schools as to Practical Science—Worrallo Whitney, Otis W. Caldwell, J. P. Gilbert, J. C. Hessler, J. T. Johnson.

Committee to Arrange for the Editorship and the Publication of a Series to be known as the State Academy Leaflets on High School Science—T. J. McCormack, William C. Bagley, J. G. Coulter, R. D. Salisbury, H. S. Pepoon.

Publication Committee—The president, the secretary and A. R. Crook.

Committee on Ecological Survey—Stephen A. Forbes, V. E. Shelford, Frank C. Baker, Charles C. Adams, H. A. Gleason.

Committee to Influence Legislation to Restrict the Collection of Birds and Eggs to Institutions and Accredited Individuals—F. C. Baker, I. E. Hess and F. L. Charles.

Committee to Cooperate with Existing Agencies for Advancement of Nature Study in Elementary Schools—F. L. Charles, Ira Meyers and Ruth Marshall.

The program was as follows (the papers and addresses will be published in Volume IV. of the *Transactions*).

FRIDAY, 10:00 A.M.—*Botany Building*

Address of Welcome, Dean R. D. Salisbury.

"Charles R. Barnes: In Memoriam," John M. Coulter.

"Frank G. Barnes: In Memoriam," R. O. Graham.

"J. A. West," S. A. Forbes.

"J. C. Stine: In Memoriam," Frank Smith.

"The Postglacial Life of Wilmette Bay" (lantern), Frank C. Baker.

"Description of Mine Rescue Stations" (lantern), H. H. Stock.

FRIDAY, 2:00 P.M.—*Botany Building*

"Mollusca of Piatt, Vermillion and Champaign Counties" (lantern), James Zetek.

"Oil Investigation in Illinois" (lantern), R. S. Blatchley.

"Seasonal Succession in Old Forest Ponds" (lantern), W. C. Allee.

"Demonstration of Movement of Water in Leaves" (lantern), A. H. Cole.

"The Chinese Mantis in Southern Illinois," C. A. Hart.

"Eastward Extension of Certain Shales as Shown by Deep Wells," J. A. Udden.

"Present Status of Illinois State Museum," A. R. Crook.

"Demonstration of the Use of Oxygen in Mine Rescue Work," J. M. Webb.

"Metallic Colors in Birds and Insects" (lantern), A. A. Michelson.

FRIDAY, 8:00 P.M.—*Mandel Hall*

Presidential address, "The Problems of Plant Breeding," John M. Coulter.

SATURDAY, 9:00 A.M.—*Mandel Hall*

Symposium on Radio-Activity: "Radio-Activity and Geological Phenomena," T. C. Chamberlin, University of Chicago; "Some of the Physical Properties of Radium," Henry Crew, Northwestern University; "Radium in Relation to Celestial Bodies," E. B. Frost, Yerkes Observatory; "Radio-Chemistry," W. A. Noyes, University of Illinois; "The Biological Effects of Radium," W. A. Pusey, University of Illinois.

Address: "The Relation of the Soil to Plants," H. C. Cowles.

SATURDAY, 2:00 P.M.—*Botany Building*

"A Preliminary List of the Ants of Illinois," M. C. Tanquary.

"The Channahon and Essex Limestone," T. E. Savage.

"Occurrence of *Glœotœnium* in Illinois," E. N. Transeau.

"Ecological Studies of the Prairie and Forest of Illinois," C. C. Adams.

"A Handbook for Students of Animal Ecology," C. C. Adams.

"Reproduction by Layering in the Balsam Fir and other Conifers" (lantern), W. S. Cooper.

"Evaporation and Plant Succession on the Sand Dunes of Lake Michigan" (lantern), George D. Fuller.

"Structure of Adult Cycad Stem" (lantern), C. J. Chamberlain.

"An American Lepidostrobus" (lantern), John M. Coulter and W. J. G. Land.

Following the presidential address, a social hour was enjoyed in Hutchinson Hall. The social possibilities of the meetings were also taken advantage of during the noon-day luncheons served in the men's commons.

FRANK C. BAKER,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 482d regular meeting of the society was held March 18, 1911, with President David White in the chair.

Under the heading "Brief Notes," C. D. Marsh called attention to a recent paper on the "Geographic Distribution of Diatomes," by Tollinger, published in *Zoologische Jahrbücher,* Jena. The paper is chiefly remarkable for its completeness. A separate map of the distribution of each species is given.

The following communications were presented:

Raising Trailing Arbutus from the Seed: FREDERICK V. COVILLE.

A brief account of scientific phases of the experiments, the results of which were outlined, appears elsewhere in SCIENCE. The speaker exhibited a number of pots showing magnificent specimens produced from the seed and grown in the greenhouse.

Notes on Java Natural History and Salt Makers of Tjihara, Java: WILLIAM PALMER.

This was a narrative of experiences and observations made during a somewhat lengthy collecting trip to Java in 1909 and 1910. It included observations on the physical features of the island, the vegetation, the inhabitants, their mode of life and industries, the birds, mammals and other animals. The speaker closed with an account of his visit to the salt-makers of Tjihara.

D. E. LANTZ,
Recording Secretary

THE BOTANICAL SOCIETY OF WASHINGTON

THE 72d regular meeting was held at the Cosmos Club, Tuesday, April 4, 1911, at eight o'clock P.M. Both president and vice-president being absent, Dr. A. Mann was chosen chairman *pro tem.* Thirty members were in attendance.

The following papers were read:

The Study of Soil Organisms: Dr. N. A. COBB.

Notes on some of the Edible Aroids: R. A. YOUNG.

The edible aroids are of great importance in the tropics, since they form a readily available source of starch food. Practically all desirable varieties must be referred to the genera *Xanthosoma* and *Colocasia,* very few of those belonging to the genus *Alocasia* having any possible use. Although the three genera can be distinguished with little difficulty the exact botanical nomenclature of the several varieties, especially those of the genera *Xanthosoma* and *Colocasia,* is in general uncertain.

The acrid properties of the aroids, due to the presence of raphides composed of calcium oxalate in their tissues, are very pronounced. However, the tubers of many forms are non-acrid, and in *C. gigantea* Hooker the entire plant is non-acrid. A peculiarity of the older leaves of this species is the development on the ventral surface of sharply defined, irregular, dark green discs on either side of the midrib.

When the corms of the aroids are cooked a violet color develops, the source of which is at present unexplained.

Inheritance of Aleurone Color in Corn Hybrids: G. N. COLLINS.

This paper reported the behavior of the aleurone color in a series of hybrids between diverse types of maize. The aleurone color of corn, while of no practical importance, affords exceptional opportunities for studies of inheritance. Being a part of the endosperm the characters of the aleurone cells are subject to xenia, that is, they develop from the union of the second nucleus of the pollen tube and the endosperm nucleus and may be looked upon as belonging to the same generation as the embryo. Ordinarily in tracing the behavior of

characters it is necessary to grow hundreds of the hybrid plants or animals in order to secure reliable averages, while with xenia characters similar numbers can be secured by a single pollination and can be observed the same season that the cross is made.

Crosses between white varieties and those possessing a variety of aleurone colors has shown that the law of dominance holds with considerable regularity. Instances of partial dominance occur but are comparatively infrequent. One case was reported in which a blue aleurone color was definitely recessive to white. In the second or perjugate generation segregation, while comparatively definite, seems not to result in the usual ratios. Out of 200 different combinations only 16 approximated the usual ratios of a monohybrid. There was a great variety in the ratios obtained, the most frequent being one colored to two colorless, or 33⅓ per cent. This was approximated within twice the probable error in 22 instances out of 200. It was pointed out that this 1:2 ratio could not be explained by supposing that pure recessive or pure dominants were unable to develop. The regular arrangement of seeds on the ear would render omissions of this kind apparent.

Since the number of seeds on the individual ears was large enough to afford reliable averages, it was held that the differences found were significant, while any attempt to explain the unusual ratios by assuming different combinations of distinct factors for the same character would reduce the whole conception to an absurdity.

W. W. Stockberger,
Corresponding Secretary

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

The 452d regular meeting of the society was held in the hall of the Public Library, February 21, 1911, 8 P.M., with Mr. George R. Stetson, vice-president of the society, in the chair.

Dr. Daniel Folkmar presented a paper on "Some Questions Arising in the First Census of European Races in the United States." The speaker, who is chief of the section on the foreign-born in the thirteenth census, and author of the "Dictionary of European and other Immigrant Races," dwelt at some length on the new feature introduced in the present census, namely, of classifying the foreign-born by their mother-tongue, in addition to that by country or political allegiance. The main part of the discourse was, however, occupied with a defense of the terminology, or nomenclature, adopted in the schedules of the census and in the dictionary, viz., "race" to designate the linguistic divisions of the immigrants, and "nationality" for the country of birth. The speaker admitted that in anthropology and biology the term race is applied to physical traits, but maintained that with the census it was not strictly a scientific question but a practical one, to designate and distinguish given groups of peoples who come to the shores of this country. "Race" seemed to him justified to designate linguistic groups, inasmuch as it points out something essential, which descends by heredity.

The paper as well as the dictionary, which the author laid before the society, were discussed at some length by Drs. Hrdlička, Michelson and Hough, and by Mr. Disserond.

I. M. Casanowicz,
Secretary

THE AMERICAN CHEMICAL SOCIETY
NEW YORK SECTION

The seventh regular meeting of the session of 1910–11 was held at Rumford Hall in conjunction with the American Electrochemical Society, on April 7. Professor Chas. Baskerville presided.

The chairman announced that the section would be deprived of the pleasure of listening to Mrs. Ellen H. Richards at the May meeting by her death, which took place a short time ago, and called upon the secretary, one of her former students, to speak of her life and work. The chairman further announced the death of Mr. B. G. Amend, a former member of the section, and asked Dr. Chas. A. Doremus to say something in this connection. Following Dr. Doremus's remarks, the meeting rose in memory of the two deceased.

The chairman spoke of the work of the Municipal Explosives Commission and called upon Dr. C. F. McKenna to speak on "Suggestions as to Public Safety." The subject was further discussed by Dr. Wm. Jay Schieffelin and Mr. G. W. Thompson.

Professor Wm. H. Walker, president of the American Electrochemical Society, then made his presidential address entitled "Chemical Research and Industrial Progress."

At the conclusion of the address the chairman asked President Walker to preside. Dr. Walker took the chair and called upon Dr. H. E. Patten, of the Bureau of Soils, to present his paper on "The Relation of Surface Tension to Electrochemical Action."

C. M. Joyce,
Secretary